

A HISTORY OF
OTO-LARYNGOLOGY

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A HISTORY OF OTO-LARYNGOLOGY

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PREFACE

THIS is the first history of the specialty of oto-laryngology to be written. It seemed to the authors that, as oto-laryngology is now a fully established branch of medicine, it would be well to examine its development, to study the available literature and to publish the narrative of its rise and progress from the earliest times to the present. The immediate stimulus for the production of the work has been the forthcoming International Congress of Otolaryngology (without a hyphen, be it noted), in London, in July 1949. Although the authors, who had worked independently until each discovered that the other was engaged in the same task, have consulted original sources for most of their information, they naturally owe much to the previous historians of laryngology and of otology. The first was Dr. W. Gordon Holmes (1846-1927), the London laryngologist, a classical scholar originally from Dublin, who published his "History of Laryngology from the Earliest Times" in the columns of the weekly "Medical Press and Circular" in 1885, but apparently never republished it in book form in English, although French and German translations (by Calmettes and by Koerner) were published in 1887. Dr. Jonathan Wright (1860-1928), the New York laryngologist and pathologist, published in 1902 his book entitled "The Nose and Throat in Medical History", reprinted from the monthly "Laryngoscope"; a second and revised edition, entitled "A History of Laryngology and Rhinology", was published in 1914. Dr. C. Chauveau, of Paris, published between 1901 and 1906 his "Histoire des maladies du pharynx" in five volumes, dealing in almost too much detail with the history of diseases of the pharynx up to the year 1875. Adam Politzer (1835-1920), the founder of the great Viennese school of otology, published his monumental two-volume history of otology, "Geschichte der Ohrenheilkunde", in 1907 and 1913. In 1914 Karl Kassel wrote his "Geschichte der Nasenheilkunde", on rhinology, but only the first volume appeared, although a comprehensive treatise was contemplated. Numerous articles in medical journals and a few chapters in books have dealt with various facets of the history of

laryngology, rhinology and otology, but the time is obviously ripe for an assessment of the subject as a whole.

The authors would wish to express their gratitude for the kind helpfulness of many librarians in many libraries—the Royal Society of Medicine, the British Medical Association, the British Museum, the Athenaeum, the University of Edinburgh, the Royal College of Physicians of Edinburgh, the Royal College of Surgeons of Edinburgh, and the National Library of Scotland. Mr. Carl Eisinger, Mr. Gavin Young, Mr. John Gerrie and Mr. R. J. Cann have kindly supplied information on certain points. The illustrations have come from many sources, especially from old books and old prints, and the authors acknowledge with thanks the courtesy of the Wellcome Historical Medical Museum, of Mr. G. G. Coulton and the Cambridge University Press, of Mr. W. M. Mollison, of Dr. Irwin Moore, of Mr. C. J. S. Thompson, and of Drs. Chevalier and C. L. Jackson. For the loan of a number of portraits, and especially for permission to reproduce the portrait of Joseph Toynbee, they are greatly obliged to the Royal Society of Medicine, for permission to reproduce the portrait of Manoel Garcia to the owners, the Rhode Island School of Design, and of James Yearsley to the Metropolitan Ear, Nose and Throat Hospital. The Editor of "The Journal of Laryngology and Otology" and Messrs. J. & A. Churchill have each kindly lent a number of blocks for reproduction. Lastly, the authors thank their publishers for all their trouble, patience and courtesy.

R. S. S.
D. G.

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CHAPTER I

INTRODUCTION

BE SIDE the main stream of the progress of medicine, the history of oto-laryngology is but a small if sometimes turbulent tributary, and while it may possess an undoubted fascination to others besides its own practitioners, it should be studied always with due regard to the influence upon it of the discoveries and advances of general medicine and surgery. The Egyptians, Herodotus tells us, had medical specialists of the narrowest type, some devoting themselves to one part of the body and others to one disease only, though some historians have suggested that Herodotus exaggerated the extent of medical specialization in Egypt; nevertheless, there were so many physicians in that country that Homer declared that all Egyptians were physicians, and there can be little doubt that specialists flourished in such an atmosphere. Specialism, as we know it, is of relatively recent development. The modern specialties arose as medical knowledge grew during the eighteenth century, first oculists, followed by obstetricians and gynaecologists, and then aurists. Special hospitals did not appear until the nineteenth century and special departments of general hospitals came after them; the first special hospital in England was Moorfields, founded in 1805, for diseases of the eye and, for the first two years of its existence, of the ear.

The specialties of otology and laryngology have different origins, for the early otologists were surgeons, who were accustomed to the use of the syringe, the scalpel and the trephine, and the early laryngologists were physicians, who extended to the larynx their interest in and knowledge of the chest. From the first, laryngology included the study of the throat or pharynx, although this part was never accorded any separate “-ology” of its own, and later it extended its ambit to include rhinology—the study of the nose, paranasal sinuses and nasopharynx. Rhinology, the link between otology and laryngology, is not only of great importance to both, but is apparently the most ancient of the medical specialties. The earliest physician whose name is known to us was the Egyptian Sekhet'enanch, who lived about 3500 B.C.,

and was the medical attendant of Sahura, one of the Pharaohs of the fifth dynasty. A limestone slab carved with a drawing of this physician and his wife, which was first set up as a memorial in an ante-room of the palace at the suggestion of the physician himself, and later placed in the tomb of the king, where it was discovered, bears the legend, "He healed the King's nostrils".

The most popular and successful surgeon of the Georgian era, Sir Astley Paston Cooper, whose elegant and brilliant figure

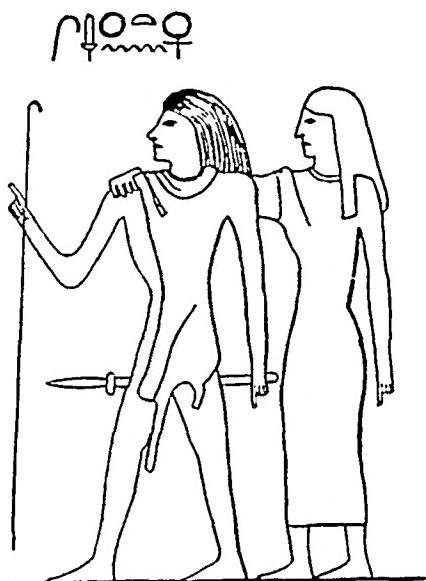


FIG. 1
Sekhet'enanch and his Wife, 3500 B.C.

stands astride the end of the eighteenth century and the beginning of the nineteenth, gained the Copley Medal of the Royal Society in 1802 for curing deafness (temporarily, alas !) by puncturing the tympanic membrane, but he did not pursue the surgery of the ear "as he was afraid to be thought an aurist", and he left it to his successors in the thirties and forties of the nineteenth century to raise otology from empiricism. But the great anatomists of the Renaissance were familiar with the intricacies of the ear; in 1724 Guyot, the postmaster at Versailles, invented the Eustachian catheter in order to relieve his own deafness, and the science of otology is the natural culmination of centuries of studies in the anatomy, physiology and pathology of the organ of hearing.

Laryngology slumbered even longer than otology. The late Sir St. Clair Thomson, laryngologist, orator and wit, once in

beginning a lecture on a medical historical subject quoted the advice of a practically-minded American country doctor of the horse-and-buggy days, "Cut out Hippocrates and all them Latin authors!" And it would be easy to omit the ancients in writing the story of laryngology, strictly so-called. For laryngology began one sunny afternoon in September 1854, when Manoel Garcia, a Spanish singing-teacher who lived and taught in London, was on holiday in Paris, and, strolling in the garden of the Palais Royal, observed the flashing of the sun on the window-panes of the colonnaded quadrangle. Preoccupied with the problems of falsetto and the registers of the human voice, he had long yearned to see the movements of the vocal cords, an idea which he had often repressed as quite unrealizable, and the flashing of the sunshine suddenly gave him a vision "as if actually present before his eyes" of one mirror reflected in another. Obtaining a long-handled dental mirror, he hurried to his hotel, warmed the little mirror in hot water, dried it, held it against his uvula and, reflecting a ray of sunlight upon it with a hand-mirror, was overjoyed to see in it his own glottis so wide open that the trachea was visible; when his excitement subsided he began to study what was passing before his eyes, and the way in which the vocal cords opened and shut filled him with wonder. It is true that Garcia had predecessors, unknown to him, who had tried to use laryngeal mirrors with varying success, and that it was Türck and Czermak and their pupils who applied laryngoscopy to medicine; the place of Garcia in relation to his predecessors and successors will be discussed in due course, but he and no other has been acclaimed as the true "Father of Laryngology".

Not only advances in medicine but progress in all branches of human endeavour were swift and exciting in the fifties of the nineteenth century. Garcia's invention of the laryngoscope came in the middle of those twenty most marvellous Victorian years, which began with 1847 when James Young Simpson introduced chloroform, Semmelweis discovered the cause of puerperal fever, and James Young distilled petroleum, and ended with 1867 when Lister introduced antiseptic surgery, the Suez Canal was opened, the Dominion of Canada was established—and Karl Marx published "Das Kapital". Those were the days of such historical tragedies as the Crimean War, the American Civil War, and the *coup d'état* that set Napoleon III on the Imperial throne of France, but also of the Geneva Red Cross Convention and the Great

Exhibition of 1851 ; of Lincoln and Bismarck, the rise to fame of Disraeli and Gladstone ; the foundation of the first national Trades Union (the Amalgamated Society of Engineers in 1851) and the first Trades Union Congress (in 1860) ; of Dickens and Thackeray, Browning and Elizabeth Barrett Browning, Tennyson and the young Swinburne, Carlyle and Macaulay, Nathaniel Hawthorne and Oliver Wendell Holmes ; of Dumas, Balzac and Victor Hugo ; the last years of Chopin ; the triumph of Turner, the rise of the English pre-Raphaelite painters and of James McNeill Whistler, and the beginnings of the great French impressionists (Manet's "Olympia" was exhibited in 1856) ; when (in 1859) Darwin published his "Origin of Species" and Wagner completed the score of "Tristan".

Those were the days of Claude Bernard, founder of experimental medicine, who said, "Put off your imagination as you take off your overcoat when you enter the laboratory—but put it on again as you do your overcoat when you leave the laboratory", and of Carl Ludwig, described by Sir Lauder Brunton as "like one of the great architects of the Middle Ages who built the wonderful cathedrals we all admire and whose name no man knows" ; of Virchow the founder of pathology, Fehling of Fehling's test, Raynaud of Raynaud's disease, Bright of Bright's disease, von Graefe the founder of ophthalmic surgery, and William Farr the first medical statistician ; when (in 1849) Addison described pernicious anaemia and Waller degeneration of the spinal nerves ; when Marion Sims founded modern gynaecology with his successful operation for vesico-vaginal fistula ; when Helmholtz, whose theory of hearing still holds, invented the ophthalmoscope ; when Pasteur demonstrated the presence of bacteria in the air (1860), Broca discovered the speech centre in the brain (1861), and Mendel published his memoir on plant hybridity (1865) ; when Florence Nightingale—"no swan, but an eagle", as Lytton Strachey described her—reformed nursing, and the Medical Act of 1858 reformed the medical profession.

Only during the present century did otology and laryngology become united under the comprehensive term of oto-laryngology, and as late as 1919 Sir Felix Semon (according to his autobiography) was protesting against the tendency to combine otology and laryngology. Today oto-rhino-laryngology—to use the more accurate and comprehensive but more clumsy term—has become recognized as a single and distinct specialty, and in the great

teaching hospitals of London, where until quite recently there were separate departments for diseases of the ear and for diseases of the nose and throat, these departments have now all been amalgamated. To otology, rhinology and laryngology, bronchoscopy and oesophagoscopy, or peroral endoscopy, has in recent years been added—though it is already slipping from the otolaryngologist's hands into those of the thoracic surgeon and the gastro-enterologist. The exponents of oto-laryngology are now surgeons and not physicians, but their attitude today is more conservative than it was a generation ago, partly owing to the emphasis on restoration of function, partly to earlier recognition of acute infections, and partly to the introduction of chemotherapy and antibiotics. Radiotherapy, with improvements in technique, is replacing surgery to a considerable degree in the treatment of malignant disease of the nose and throat. The elaboration of the tests of hearing and equilibration, the education of deaf-mutes, and the problems of prosthesis and rehabilitation in acquired deafness, are constantly extending the boundaries of otology. Whether oto-laryngology will subdivide further, or whether it will, on the contrary, amalgamate with other branches of medicine and surgery, lies in the history of the future.

CHAPTER II

ANCIENT HISTORY

FOLK-LORE is handed down the generations by speech rather than by writing, and folk-medicine, which is probably the most ancient form of medical practice, supplies some strange data with regard to the ear, nose and throat.

THE FOLK-LORE OF OTO-LARYNGOLOGY

Curious superstitions are centred in the ear, perhaps the most peculiar the belief that the conception of the Virgin Mary arose from the breath of the Holy Ghost in her ear, a legend frequently illustrated by medieval artists. The birth of children by way of the ear is mentioned as a common if innocent belief in the imaginative writings of Rabelais and of Molière, and is also to be found in Mongolian, Persian and Indian legends. According to Pliny, the seat of memory was in the lower part of the ear, and Noury observes that Nemesis, the goddess of retribution, was supposed to reside behind the right ear.

From time to time the size and shape of the ear have been regarded as an indication of a person's character—small ears indicating mental ability and truthfulness ; large ears show dull wit according to one report, generosity according to another (Rolleston). Among other curious fictions which have persisted for centuries, is the belief that if the ears tingle someone is speaking about you ; this dates back to the time of Pliny, who states that it was then universally accepted ; Bergen writes that in rural Maine and Pennsylvania the popular notion is that if your right ear burns the speaker is a woman, and if the left a man.

The administration of poison by way of the ear, as mentioned in "Hamlet", the wearing of ear-rings to cure weak eyes and strengthen the sight, the use of black wool, or lamb's wool, to ward off deafness, the legend that earwigs will enter the brain by the ear—all those peculiar beliefs have been perpetuated down the ages to the present day. The folk-lore remedies which have been in use since prehistoric times are numerous and varied—juice of snails, a wild goat's gall, the urine of bulls, the blood of moles, and all manner of decoctions and juices of plants, vegetables and

fruits. There is indeed no end to the pharmacopoeia of "ear drops". In Morocco, according to Legey, rain water is collected on March 25th for every disease of the ear and nose. In contrast with the ear and the larynx, the nose has long had an abundance of popular synonyms, no doubt because of its prominence in the face. The Greek Anthology contains several comic epigrams on large noses, and a popular belief in a close relation between the size of the nose and the sexual organs dates back to ancient times. The folk-lore connected with sneezing is abundant, and the act is mentioned in the Bible (*2 Kings*, 4 : 35) as well as in Homer, Xenophon and Petronius. Epistaxis is the most common nasal condition for which folk-medicine is used : the patient's own blood ; hemlock, moss and many other plant remedies ; according to Black the common remedy of slipping a key down between the clothes and the skin is Norse and connected with Thor ; cold water and vinegar or salt to the forehead or hands or feet ; various charms and prayers. Nasal catarrh or a cold was treated in Western Bohemia by inhaling a child's warm urine ; Hovorka and Kronfeld, among other "transfer" remedies, mention smearing a door handle with the mucus early in the day when the first to turn the handle will catch the cold ; inunction of the nose with butter or tallow is another folk-remedy.

The folk-lore remedies for affections of the throat include a liniment derived from centipedes, the juice of crabs, an owl's brain, and the ashes of a burnt swallow ; plant remedies such as bishopwort, cabbage, garlic, nettles, pennyroyal and sorrel ; the wearing of beads of various kinds or a black silk cord round the throat ; abstention from meat ; rest in a quiet place and ingestion of two spoonfuls of butter boiled with one spoonful of honey (Cockayne) ; and excommunication of the sore throat in the name of God and the Holy Virgin (Cabànès and Barraud).

One of the earliest popular methods of dealing with diseases of the throat appears in the writings of Celsus ("De Medicina", iv, 7) : "I hear it commonly said that if a man eat a nestling swallow, for a whole year he will not be in danger from angina, and that when the disease attacks anyone it is beneficial to burn a nestling swallow which has been preserved in salt and to crumble the powdered ash into hydromel which is administered as a draught. Since this remedy has considerable popular authority, and cannot possibly be a danger, although I have not read of it in medical authorities, yet I thought it should be inserted here in my work."

Pliny mentions various popular local applications, such as the dung of lambs before they have begun to graze, the juices of a snail pierced with a needle, gargles of sheep's milk.

OTO-LARYNGOLOGY IN EGYPTIAN PAPYRI

The earliest medical writing is to be found in Egyptian papyri, the most famous of which is the Papyrus Ebers, discovered in a tomb at Thebes and sold by an Arab, in 1872, to Dr. Ebers of Leipzig. It is believed to have been written about 1550 B.C. and consists, for the most part, of lists of empiric remedies, plentifully sprinkled with spells and incantations. A number of the prescriptions are remedies for deafness and for aural discharge. For example : "For an ear that hears badly—red lead, and resin ; grind to powder, rub in fresh olive oil, and apply to the ear" ; and, "For an ear that is suppurating, olive oil, frankincense, and sea salt, syringed into the ear" ; and, again, "To dry an ear that is running, vermillion, cumin, ass's ear, and olive oil". There is no allusion in the Papyrus Ebers to any affection of the throat.

Such treatment as was given was entirely random and empiric, which is not surprising in the complete absence of anatomical background. The knowledge which might have been gained by the process of embalming and the making of mummies did not concern an organ so intricate as the ear, or so deep as the larynx. Apparently, however, the existence of the auditory or Eustachian tube was recognized, as the papyrus states "the breath of life passes by the right ear, the breath of death by the left ear". This strange conception of the ears as avenues of respiration was mentioned some centuries later by the Greek philosopher Alcmaeon, in 580 B.C., when he affirmed that goats breathed through their ears.

The oldest known surgical treatise, the Edwin Smith Papyrus, said to be at least as old as Papyrus Ebers, probably before 1600 B.C., and now preserved at Chicago, is a sort of textbook of traumatic surgery, beginning with injuries to the head and continuing down the body, although it stops short at the thorax. It describes some fifty surgical cases, but there is little reference to the ears, although the frequency of bleeding from the ear in head injuries is noted, and regarded as an unfavourable sign. The treatment of a fractured nose is given in detail ; every "worm" of blood is to be removed, the displaced bone is to be forced back, and the nostrils packed with strips of linen saturated with grease

and honey. The Edwin Smith Papyrus describes a crushing injury of the neck causing loss of speech, and a wound of the gullet accompanied by fever.

The Papyrus Brugsch, a later and more fragmentary document, recommends the use of verdigris (copper sulphate) as a paste in cases of otitis, a disease which is picturesquely described as "fire in the heart of the ear".

ANCIENT HEBREW OTO-LARYNGOLOGY

The available records of early Jewish medicine in the Bible and the Talmud supply very little information regarding the ear and its diseases. The Bible contains much information on personal and social hygiene, but there is a disappointing absence of references to medicine and surgery. Few remedies are mentioned, although Naaman was told to wash seven times in the River Jordan, Hezekiah was bidden to apply a lump of figs to his boil, and the son of the widow of Zarephath was resuscitated by artificial respiration. In each case the treatment was applied by "a man of God", and there appears to have been a reluctance to admit that disease could be cured without the employment of supernatural means. Sickness was often attributed to the wrath of God and the remedy was to be found in prayer and sacrifice.

The plagues and other communicable diseases mentioned in the Bible are so vaguely described that it is not possible to identify them with accuracy. The throat is not mentioned in the Pentateuch, and the word for the neck, *tzavor*, refers merely to the anatomical structure that joins the head to the chest (*Gen. 33: 4*, *Gen. 45: 14*). The lips, as well as the mouth and tongue, represent the organs of speech (*Ex. 4: 10*); the nose is recognized as the organ for breathing (*Gen. 2: 7*). *Askara* has been identified with diphtheria, but may have been scarlet fever.

The Talmud is essentially the law as transmitted by verbal tradition, the usual source of reference being the treatises on the Babylonian Talmud (A.D. 352-427). In the Talmud there appears considerable knowledge of anatomy and surgery, including that of the ear, nose and throat. The methods of aural treatment noted are empiric: for instance, it is mentioned that fluids are harmful to the ears, with the exception of fluid from the kidneys. Otitis is to be treated by "roasting upon embers the kidney of a goat", collecting the juice and instilling it into the ear. It is to be noted

that one of the oldest folk-remedies for deafness, still in use even today in primitive communities, is the introduction of a little of the patient's urine into the ear.

In the Talmud it is observed that "a polyp shows itself by a bad smell of the nose". A swelling in the throat is mentioned, which appears to have been quinsy; a transverse division of the trachea is stated to be fatal, but not a longitudinal section, so long as there is an undivided part at the top and bottom.

HINDU AND CHINESE OTO-LARYNGOLOGY

Another ancient civilization was that of the Hindus, in whose classic documents, notably the Sanskrit Atharva-veda (*ca.* 700 B.C.), there is much medical information, including descriptions of diseases of the ear, nose and throat. The greatest of Hindu surgeons was apparently Susruta (fifth century A.D.), but Baas has suggested that ancient Hindu medicine was derived from the Hippocratic system, and even that the name "Susruta" may be a Hindu corruption of Hippocrates. The most noteworthy achievement in Hindu surgery was the manufacture of new noses by flaps from the cheek or forehead to replace the loss of tissue caused by cutting off the nose, the usual punishment for adultery. The Hindus were thus the originators of modern rhinoplasty. They used the leaves of trees as patterns for the flap, and they were wont to teach and to practise surgery by carving and puncturing plants and gourds, thus acquiring the necessary skill before operating upon the human body.

The Atharva-veda contains many but vague allusions to diseases of the throat, though there is one obvious reference to quinsy ("Tumor rigidus, in palati regione a sanguine ortus existit", in Hessler's Latin translation); uvulotomy and (possibly) tonsillotomy are also mentioned. Vaporization and fumigation through a tube were commonly employed for diseases of the nose and throat, and local applications of ointments were made to the nostrils. Fracture of the nose was treated by raising the depressed bones by a special instrument and retaining them in position by a hollow tube kept in the nostrils. T. A. Wise says that the scanty knowledge of anatomy is evident from the Hindus employing the word "Khunt" to designate the throat, including both the trachea and oesophagus, and the term "Kulee", including the heart, liver, spleen and stomach.

Chinese medicine also has a very ancient history. The methods of treatment consisted largely in puncture, at various points, with long needles—acupuncture, and the use of a large variety of drugs of animal and vegetable origin. It is interesting to note that the drug ephedrine (Ma Huang) was known in China many centuries before it was used in America or Europe.

OTO-LARYNGOLOGY IN GREEK AND ROMAN TIMES

It was not until the time of Hippocrates that medicine was separated from magic and disease was regarded as a natural phenomenon. The books grouped under the name of Hippocrates may well be the remains of the library of the Hippocratic School or family of the Asclepiadae on the island of Cos, a school which flourished during the fourth and fifth centuries B.C. The Asclepiadae professed to be descended from the mythical physician, the deified Asclepius, and Hippocrates, the most celebrated member of the school, is said to have been born at Cos in 460 B.C. His father was Heraclides, and his teachers were his father and Herodicus. He was consulted by Perdiccas, King of Macedonia, and by Artaxerxes, King of Persia, and his life was a long one, the date of his death uncertain. The great contribution of Hippocrates to medicine, apart from his noble ethical code, the Hippocratic Oath, was his insistence upon the value of observation and his acceptance of disease as a natural phenomenon. His case records were concise and accurate, very different from the boastful accounts which issued from the temples of Aesculapius at that time. His treatment was for the most part climatic and dietetic, and he enunciated the great law of *Vis medicatrix Naturae*—“Our Natures are the physicians of our diseases”.

Hippocrates was probably the first to inspect the tympanic membrane, “a dry thin-spun web”, and to recognize it as part of the organ of hearing. Among his “Aphorisms” we find the following: “Children suffer from ear discharge; adults from deafness”. “Headache, otorrhoea, and high palate with irregular teeth are often associated.” He clearly described acute otitis, and he regarded otorrhoea as secondary to cerebral abscess—centuries were to elapse before Morgagni showed that suppuration in the ear was the primary lesion. One of his most interesting observations concerns a case of head injury followed by otitis and meningitis. It is worthy to be quoted in full:

"The daughter of Nerios, a beautiful maiden aged twenty, was playing with a girl friend, who struck her with the open hand on the top of the head. She saw a blackness before her eyes, and lost her breath, and on getting home was taken with severe fever, with headache, and redness of the face. On the seventh day there issued from the right ear more than a cupful of fetid reddish pus, and she seemed a little relieved. But the fever returned, she became comatose and speechless ; the right side of the face was drawn ; spasms, tremor, and breathlessness followed ; her tongue and eyes became paralysed ; she died on the ninth day."

Other case records of otitis, almost equally detailed, are to be found in the Hippocratic works. We are told, for example, that there may be " pain and fever, followed by discharge in five to eight days, when the symptoms abate. Cessation of the discharge shortly after its commencement is often fatal. The discharge is at first watery, then purulent." In accordance with the usual Hippocratic practice, the treatment is physical and dietetic : the patient is to be fed with honey water and barley broth, and his head is to be sponged with hot water ; the application of steam is also advised.

Hippocrates devotes much attention to fractures of the nose, stress being laid on the necessity of replacement of a fracture within the first twenty-four or thirty-six hours after the injury. For lifting the fragments of bone into place he preferred the fingers, and internal splints of "Carthaginian leather" were used, the use of sponges being condemned because they soon became foul from the discharges. In the treatment of a lateral displacement of the nose he advised that an internal splint be inserted as usual, and then a long leather thong glued at one end to the point of the nose which was pulled beyond the median line to the opposite side, and the thong wound round the head and fastened by gluing to the temples—this could then be pulled more taut or loosened as occasion required.

The sponge method which Hippocrates employed to remove nasal polypi was practised by rhinologists certainly as late as the eighties of the nineteenth century and probably even later—it is mentioned in Voltolini's textbook in 1888. It was used successfully for the soft polypi which move in the nostril on expiration and inspiration. The ends of three or four strings were tied to a sponge cut to the proper size and shape, and the other ends knotted together were fastened to the eye of a soft malleable tin

or lead probe which was pushed through the nose into the pharynx; the ends of the strings thus secured were passed over the end of a forked probe held in the pharynx, and by traction across this the sponge was dragged into the pharynx, bringing the polypi—if successful—with it.

The anatomical knowledge of Hippocrates was very limited, and the structure of the windpipe is not described in his writings nor the larynx differentiated from the rest of it. Apart from the epiglottis, the larynx was apparently unknown to the Hippocratic school, though the state of the voice received special attention. The first appearance of the word “larynx” is in the comedy “The Knights” by Aristophanes (line 1363), produced in Athens in 425 B.C., where mention is made of holding a person suspended by the larynx as a punishment for certain reprehensible utterances. The words “larynx” and “pharynx” were apparently used indiscriminately by the ancient Greek authors, and the word “pharynx” (but not “larynx”) is found as early as the “Odyssey” of Homer (ix, 373).

“The larynx”, says Hippocrates, “leads to the lungs, artery, and thence to the top of the bladder” (“De Morbis”, iv, 18), but the epiglottis was observed as covering the windpipe and was given its name (“De Corde”) from its relation to the tongue. The general belief in those times was that drink passed by the windpipe into the lungs, but Hippocrates refutes this (“De Corde”) as an erroneous idea. Of the vocal and respiratory action of the larynx Hippocrates had no idea, although the state of the voice in disease was a subject of special attention, and its clearness, hoarseness, shrillness and failure are often mentioned as furnishing important diagnostic and prognostic information. Before the time of Hippocrates all inflammations of the throat and neck were designated by the single term *cynanche*, but in the Hippocratic writings this name was reserved for internal inflammations. Hippocrates describes the etiology of *cynanche* as follows (“De Victu Acutorum”, c. 4): “In winter or spring when a copious and tardy flow takes place from the head to the jugular veins, which attract it on account of their size. But being cold and viscid it obstructs, and closing the ways of the breath and blood, condenses the proximate blood and renders it immobile and stable.”

Hippocrates studied symptoms rather than the treatment of disease, and his descriptions are often vivid: “Ulcerations that recur on the tonsils are dangerous. When children have consider-

able ulceration of the tonsils, if they can drink, it is a sign that they may recover, the more so if they could not drink before. In cases of ulcerated tonsils, the formation of a membrane like a spider's web is not a good sign. . . . Ulcerated tonsils that occur in summer are worse than those that occur at other seasons, for they spread more rapidly. Ulcers in the tonsils that spread over the uvula alter the voice of those that recover. Ulcers that spread about the throat are more serious and acute, as they generally bring on difficulty of breathing" ("Dentition", xviii-xxxii). "It is dangerous to cut away or lance the uvula while it is red and enlarged, for inflammation and haemorrhage supervene after such treatment; but at this time try to reduce such swellings by the other means. When, however, the gathering is now complete, forming what is called 'the grape', that is, when the point of the uvula is enlarged and livid, while the upper part is thinner, it is then safe to operate. It is better too to move the bowels gently before the operation, if time permit and the patient be not suffocating" ("Prognostic", xxiii).

As regards treatment, bleeding, purging, shaving the head and fomentations were all resorted to in acute inflammations of the throat. For cynanche ("De Victu Acutorum"), bleeding, purging, hot gargles, shaving the head, and application of ointments thereto and to the neck, wrapping the neck in wool and then fomenting it with sponges of warm water, with hydromel internally, and emollient drinks. Or the bleeding may be omitted and a blister applied to the back of the neck ("De Morbis", ii, c. 9). Inhalation of a mixture of Cilician hyssop, sulphur and bitumen through a tube is also prescribed ("De Morbis", iii, c. 100). In addition, a carefully regulated diet (of mutton, fish, bread, etc.), with general hygienic methods, abstention from all excesses, and gentle out-door exercise are ordered.

Aristotle, who followed Hippocrates closely in point of time (he lived from 384 to 322 B.C.), was a philosopher rather than a physician, but nevertheless dominated the medicine of the Dark Ages and laid the foundations of comparative anatomy and embryology. He dissected the ear in many animals and he mentions the cochlea which, in his opinion, was the inner counterpart of the outer ear or auricle. He stated that no nerve connected the brain with the ear, but only a blood-vessel. In his view the seat of hearing was in the occiput, which was a cavity devoid of brain and filled with air.

Aristotle regarded the ear as the organ of air-sense, just as the nose conveyed the fire-sense and the eyes the water-sense. The ear contained air which was in direct communication with the air space at the back of the head. The cough which is caused by irritation of the external meatus suggested to Aristotle an intimate relation between the ears and the lungs. From this he reasoned that dumbness accompanied deafness. In his conception of the anatomy of the nose he placed at the top of the nostrils a kind of lid which rose at inspiration to let in the odours—"there is no passage from the ear to the brain, but there is to the roof of the mouth". He used "larynx" and "pharynx" as synonyms, and described the larynx as the organ through which the voice and the breath passed and as situated in the front part of the neck. He said that the trachea was cartilaginous, surrounded by smooth rings, and contained but little blood, but he considered the epiglottis—the absence of which in birds he noticed—as part of the tongue. He recognized that the voice was produced within the trachea by the impact of the air against it—inspired by the soul, which lay within the heart and lungs ("De Anima", ii, viii).

When the seat of Greek learning was transferred to Alexandria, two of the greatest physicians and anatomists were Herophilus and Erasistratus, both of them born about 300 b.c. Herophilus is said to have been the first to practise public dissection of the human body. He described the duodenum and also the venous sinuses of the brain, in which his name has survived—torcular Herophili (the wine-press of Herophilus). He called the hyoid bone the "parastate" because it was situated near the tonsils. Erasistratus, although he regarded the nerves as hollow tubes, noted the difference between motor and sensory nerves and distinguished the cerebrum from the cerebellum. To him is attributed the joining of the word "trachea" to "arteria", so as to distinguish the wind-pipe from other arteries. All the writings of those two great pioneers have perished—and who knows what other treasures of medicine and science were lost when a mob of fanatics set fire to the library of Alexandria?

For the next written record of any value we must turn to the work of the Roman nobleman Aulus Cornelius Celsus, who lived in the first century of the Christian era, but his medical encyclopaedia in eight books, "De Medicina", written about A.D. 30, appears to have been overlooked and virtually lost until 1478, when it was found in the Papal Library and was one of the first

medical works to be printed. Celsus wrote on many subjects, and although there is no evidence to show that he practised medicine, he gave a full and clear account of the medical knowledge of his time. He stated that otitis might lead to death or to insanity, and was to be treated with garlic juice, with tannin from gall-apples, and with a decoction of earthworms. Blood-letting and purging were advised, and an ointment was to be rubbed on the shaven head. Celsus gives an interesting description of foreign bodies in the ear : " An insect must first be killed with vinegar and then removed with a probe ; the patient should be encouraged to sneeze, or, better still, he should be bound to a table, with the affected ear downwards, and the table should then be forcibly struck with a hammer, so that the foreign body may be shaken out of the ear ".

Celsus describes the nose as follows : " The two nasal passages are separated by an intermediate bone. These begin at the eyebrows and eye-corners, and their structure is for almost a third part bony, then changes into cartilage, and the nearer they get to the mouth the more soft and fleshy their structure becomes. Now these passages are single between the highest and lowest part of the nostrils, but there they each break up into two branches, one set from the nostrils to the throat for expiration and inspiration, the other leading to the brain and split up in its last part into numerous small channels through which we get our sense of smell."

In his writing on coryza, Celsus repeats the belief of Hippocrates that some cases of phthisis owe their origin to catarrh of the nasal passages ; so far as coryza is concerned, he says, there is nothing pestiferous about it unless it ulcerates the lungs. He recommends protection from the weather, abstention from the bath, wine, and venery, and advised against over-eating ; at all stages massage and exercise are to be employed. Celsus treats throat inflammations much as Hippocrates did, cupping, bleeding, purging being the chief remedies, with gargles of hyssop, thyme, absinthe, or dried figs steeped in water ; in certain cases he advises deep incisions externally beneath the jaws and bled from the lingual veins. In quinsy he recommends an incision into the palate above the uvula. His remedy for angina of the powdered ash of a burnt nestling swallow (for which, in a scientific work, he apologizes) has already been mentioned.

Celsus in " De Medicina " (vii, 12) gives the earliest description

of tonsillectomy. He says that indurated tonsils result from inflammation and, as they are only covered by a very thin membrane, to remove them it is only necessary to separate them all around with the finger-nail and tear them out—in other words, enucleate them with the finger. If this is not possible, Celsus advises that the tonsils should be grasped with a hook and excised with a bistoury. Following this, the wound should be washed with vinegar “and the proper remedies used to arrest the bleeding”.

One of the most intelligent of the ancient physicians was Aretaeus, a native of Cappadocia, who lived shortly before the birth of Galen, probably about A.D. 80 to 160. It is curious that his writings had little or no influence upon his contemporaries or successors, for they are marked by keen observation and common sense. He gives a comprehensive description of the various appearances of the uvula in affections of the throat, he recommends the insufflation of powders through a tube in throat diseases, and makes the earliest extant allusion to tracheotomy for the relief of suffocation : “ But those who, as a precaution against suffocation arising from cynanche, cut the trachea for the dyspnoea do not seem to me to have shown by the attempt that the operation is warranted, for the heat of the inflammation becomes greater from the wound, and besides increases the dyspnoea and the cough ; but if they are both cartilaginous and unsuitable ”—and here the fragment ends abruptly.

Claudius Galenus—Galen, the Greek dictator of medicine for the next thousand years—was born at Pergamos in Asia Minor in A.D. 131. His first professional appointment was that of surgeon to the gladiators in his native city, but four years later he was drawn by ambition to Rome, where among his patients he finally numbered the Emperor Marcus Aurelius. After five years in Rome he fled to his old home in Pergamos, in A.D. 168, but within a year the Emperor summoned him back to Rome, and there he died probably about the end of the second century A.D. Galen was the most authoritative of the ancient commentators on Hippocrates, to whom he pays special tribute—“ the first to recognize what Nature does ”, and he was himself one of the first of the experimental physiologists. Although Galen derived his knowledge of anatomy from the dissection of animals—dogs, pigs and apes, he described five pairs of cranial nerves, and noted that the auditory nerve connected the outer ear with the brain, the

outer ear collected the sound and was especially attuned to the sounds of the human voice. It was Galen who first applied the term "labyrinth" to the inner ear. He does not appear to have recognized the tympanic membrane, nevertheless he noted that otitis was sometimes the sequel to infectious diseases, and he was aware that it might be associated with serious intracranial complications. Treatment, in his view, was to be based upon the nature of the disease ; if the ear felt hot, cold was to be applied and vice versa, and moisture was to be antagonized by dryness.

A favourite remedy of Galen's for otitis was warm oil, introduced by passing it from a spoon ; other instruments he used were probes, forceps and syringes, as well as hooks for the extraction of foreign bodies. He advised the promotion of drainage in cases of otitis, stating that the ear should not be occluded with wool. Although he used opium, he did so with caution, as he knew that it masked symptoms. He regarded the oil in which onions had been fried as particularly valuable as a remedy for earache, but he also mentions a large number of vegetable and animal remedies—marjoram, frankincense, cassia, bryony and other herbs, milk, white of egg and goose-grease. His surgical advice is strangely modern, when he states that carious bone should be removed after making an incision behind the ear—indeed, this suggests that Galen may have been a pioneer of mastoid surgery, although no definite case is recorded by him. For tinnitus, Galen recommended opium or mandragora. Deafness he treated by diet and purgatives, and he laid stress upon the value of chewing movements.

In the works of Galen there is a great advance in the knowledge of the anatomy of the upper air passages, as compared with that of his predecessors. He fully recognized the nose as the beginning of respiratory tract, and he described the muscles of the external nose as two in number, one on each side, for the dilatation of the nostril. But, like Hippocrates, he believed that the secretions of the respiratory tract originated in the brain and strained through the ethmoid bones into the channels of the nose—a belief which persisted for centuries. He goes on, however, sensibly, to say : " How wonderfully it is arranged that the beginning of inspiration is not directly into the trachea, but there is a certain deflection of it, as a curve, before the breath arrives in the trachea, which arrangement it seems to me had a two-fold advantage—first, because the air surrounding us is at times quite cold and the lungs

would be chilled, and secondly, because small particles of dust or ashes or anything of this kind may not fall into the trachea. In this bend, indeed, the breath may be carried further, but small particles of this kind are arrested so that they first, at this turn, fall upon soft and wet surfaces which are somewhat mucilaginous and are thus able to retain those which fall. If any get as far as the mouth, they stick to the palate and uvula."

Galen distinguished six pairs of intralaryngeal muscles, and divided them into those which open and those which close the larynx. He described the cartilages of the larynx as numbering three, the thyroid, the cricoid and the arytenoid—believing the last to be a single cartilage ; he described accurately the anatomy of the trachea, recognizing the membranous portion behind and its function in facilitating deglutition. He claimed to be the first to describe the ventricles of the larynx, and he described the vocal cords as composed of a membranous substance, so constituted as to resist the impact of the air and lubricated by mucus to prevent injury from the vibrations of a dry surface. He insisted that the larynx was the instrument of the voice, and he reproved the ignorance of those who thought that the voice was sent forth by the heart. He took especial pride in his theories about the recurrent laryngeal nerves, which he explained on the principle of the pulley, and which he claimed to have been the first to discover. He confuted the beliefs of the old Greek philosophers : " They will wonder when they hear the voice is produced from the brain, and much more after having heard that all voluntary motion is performed by the muscles. . . . For the muscles move certain parts upon which the breathing and the voice depend, and they themselves in their turn are dependent on the nerves from the brain."

Galen adopted the idea of Hippocrates that health resulted from the proper equilibrium of the four humours, the temperaments resulting from the preponderance of one or more humours ; every disease was engendered by one of the humours or several combined. He divided diseases of the nose into two classes, polypi and ozaena, for which he gave many prescriptions, chiefly compounds of iron or copper salts with honey or myrrh, oily applications, or turpentine. He does not mention the method of Hippocrates for removing nasal polypi. Galen classified inflammations of the throat as five varieties, and described what must have been diphtheria : " In another youth, about 18 years old, a cold having gone on for many days, a little fluid blood came up

HISTORY OF OTO-LARYNGOLOGY

after a cough—not much—but after this he coughed up some part of the membrane itself, which, having remained behind in the trachea, came up through the larynx into the pharynx and mouth. . . . Thenceforth the man's voice was injured, and this for some time, but eventually he recovered."

There was much soundness in Galen's therapeutics, but his greatest service to medical progress lay in his researches in experimental physiology. He noted the effect of section and of hemisection of the spinal cord, and he observed that the squealing of a pig ceased after division of the recurrent laryngeal nerve. But although Galen did much to further medical progress, it was unfortunate that his views were blindly accepted for many centuries and so fettered the human intellect that no great advance was made until the rise of Vesalius and the anatomists and physicians of the Renaissance, nearly fifteen hundred years later.

THE MIDDLE AGES AND THE RENAISSANCE

DETAILS of Roman medicine can be found as copiously in the works of the Latin poets, dramatists and historians as in those of the medical writers. Lucretius, for example, gives a vivid account of the plague at Athens and Ovid of the plague at Aegina, while Virgil, Horace and Juvenal are all full of intimate sidelights on the medicine of the times, though the Roman genius was happier in hygiene than in clinical medicine and surgery, as is exhibited today in the remains of aqueducts, sewers, baths and central heating. After the fall of the Western Roman Empire in A.D. 476 there followed those centuries of stagnation known as the Dark Ages, and in the East the pusillanimous Byzantine Empire lasted for nearly another thousand years, infertile, indolent and luxurious, while its medicine degenerated into a thing of legends, spells and charms. The one achievement of Byzantium was to preserve, as in cold storage, some of the culture and the manuscripts of Ancient Greece, and on the fall of Constantinople in 1453 priceless manuscripts and art treasures became disseminated throughout the Mediterranean countries, particularly in Italy. The invention of printing, the new astronomy of Copernicus and Galileo, the discovery of America, the revolt of Protestantism, had all contributed to the revival of learning in the West, and the influx of scholars from the East gave a new impetus to Greek scholarship (Boccaccio, for example, was impelled to translate both the "Iliad" and the "Odyssey" into Latin), all of which culminated in the great intellectual and artistic movement known to us as the Renaissance, which marked the transition from medieval to modern times and sounded the death-knell of feudalism and ecclesiasticism.

THE BYZANTINE COMPILERS

In the city of Byzantium, or Constantinople, which the Emperor Constantine had built in an effort to transfer to his Western dominion the ancient power of Rome, for a few centuries medical learning had been kept alive by a group of men who are known

in history as the Byzantine Compilers. Their work showed little originality, and much of it has been lost, but the residue gives a useful synopsis of all that was known of medicine and surgery during the early years of the Christian era.

The first was Oribasius (A.D. 326–403), who produced a vast encyclopaedia of all manner of knowledge. The medical section was intended for travellers who might find themselves in regions where no skilled medical help was available. He was followed a century later by Aëtius of Amida, on the Tigris (*ca.* A.D. 500–550), whose work is of interest to us, as it contains the best description of diseases of the ear, nose and throat to be found in ancient literature, but there is no complete modern edition of the work of Aëtius. Like Oribasius, he describes tonsillotomy, one of the most ancient of surgical operations. The tonsil is to be pulled forward by a hook, and the projecting part cut off with a knife, but the incision must include only the prominent portion, as there is danger of haemorrhage if the gland is incised too deeply. Foreign bodies in the throat are to be removed with forceps; but if the foreign body cannot be seen, the patient is given a piece of raw meat on a string, which is to be pulled up after he has swallowed it, in the hope that the intruder may be thus dislodged. Aëtius believed in the value of incantations. “Bid the patient attend to you”, he writes, “and say, ‘Bone (or whatever it is) come forth, like as Christ brought Lazarus from the tomb and Jonah from the whale’. Then take him by the throat and say, ‘Blasius, martyr and servant of Christ, saith, ‘Either come up or go down’’.” This appears to be the earliest reference in literature to the saint who heals the throat, St. Blaise or Blasius, whose aid is still invoked to this day. St. Blaise was not only patron saint of diseases of the throat, goitre and whooping-cough, but of wild animals, winds and storms, and of many crafts, such as stone-cutters, wool-combers, weavers and shoemakers. He saved the only son of a rich widow by removing a fishbone from his throat and became a bishop. Later he hid in a cave from the persecutions of Diocletian, but was captured, tortured and beheaded by Agricola, Governor of Cappadocia, on February 3rd, A.D. 316.

Other Byzantine authors were Alexander of Tralles (A.D. 525–605) and Paul of Aegina (A.D. 607–90). Alexander, who at one time taught and practised in Rome, wrote extensively and showed some originality, and he is said to have been the first to

FIG. 3
Blessing the Throat in Modern Times
(From C. J. S. Thompson's "Magic and Healing")



FIG. 2
St. Blaise
(By courtesy of Wellcome Historical Medical Museum)



prescribe rhubarb and colchicum, and also to have been the first to describe intestinal parasites. His treatment of diseases of the ear was entirely empiric, and among the many varieties of "ear drops" he recommended are the juices of numerous plants, the milk and the fat of various animals, also oil and honey. Alexander warns his readers against using opium in otitis, as it tended to disguise the symptoms; this is one of the few really enlightened remarks in his work.

Paul of Aegina is a more familiar name, as his works have been translated into English (for the Sydenham Society, 1834-47) by Dr. Francis Adams (1796-1861), the country practitioner and scholar of Banchory, in Aberdeenshire. A few of his passages may be quoted here, as they form a mirror of the medical knowledge of the seventh century A.D. Paul of Aegina (Paulus Aegineta) was the last of the Byzantine Compilers. He was a physician of high reputation who practised at Alexandria, and died there about A.D. 690. The following are a few of his comments upon diseases of the ear: "Watery discharges from the ears may be dried up by applying to them wool with alum, or with wine and honey, or by an injection of old wine. . . . Dullness of hearing may be prevented by cleaning away the sordes from the meatus. Afterwards, the meatus is to be anointed with the fat of geese or a small quantity of ox-gall heated in the hollow of the root of asphodel. . . . Earache may be cured by calefacient remedies, as hot oil of rue, or that of marjoram, or oil in which onion has been boiled. Other remedies include goat's gall, and juice of leeks, but when the pain is occasioned by a windy spirit, it may be remedied by cupping near the ear. . . . Everything applied to the ear should be moderately warm. . . . For worms in the ear, wash with a decoction of wormwood or of centaury, inject the juice of the fruit of capers, or old human urine. . . . Noises in the ear in fevers will commonly cease of themselves, but if they remain, inject the juice of radish with rose-oil, or that of hellebore with vinegar. . . . Congenital deafness is incurable. For deafness occasioned by thick humours, inject those things recommended for noises, but particularly applicable is the urine of a goat and the gall of a goat mixed together."

In the section of his work dealing with diseases of the nose, Paul wisely advises: "Before treating affections of the nose, the whole body must be treated. Theriac is to be drunk with advantage; venesection is recommended. . . . For polypus, a preternatural

tumour in the nose, blow in a mixture of copperas, flakes of copper, and black hellebore. . . . If friable, insensible, and not malignant, the growth may be removed by a polypus scalpel, shaped like a myrtle-leaf, to cut around the tumour where it adheres." After the operation, there may be "fleshy bodies which have not been reached with the polypus instrument". A knotted cord is introduced into the nose and passed out by way of the palate and mouth. Then, "drawing it with both hands, we saw away, as it were, with the knots the fleshy bodies. . . . During the whole treatment we keep leaden tubes in the nose." This "sawing out" of polypi by means of a knotted cord is mentioned also by the Arabian physicians who followed. Paul of Aegina describes the removal of tonsils by hook and scalpel, just as Aëtius had done, although this operation was of still more ancient date ; he checked the bleeding by gargling with the juice of plantain or comfrey. In inflammation about the mouth and palate, he sometimes has recourse to "laryngotomy": "We slit open the arteria aspera about the third or fourth ring, after bending the patient's head backwards to bring the windpipe better into view. . . . We judge that the windpipe has been opened from the whiffing noise of the air, and from the voice being lost." A very similar description had been given by Antyllus.

Paul described what was probably diphtheria—a variety of "inflammation of the tonsils and uvula which may be pestilential and fatal. . . . The ulcer may pass down the trachea and occasion suffocation. Children are most subject to it." He did not advise tracheotomy, and although this operation is of very ancient date it appears to have been recommended chiefly for the severe inflammation of the pharynx and larynx known as "cynanche", which we should diagnose today as acute streptococcal infection or as peritonsillar abscess (quinsy). The treatment recommended by Paul of Aegina was " poulticing of the neck with barley meal and the droppings of swallows, or dog's dung, dried and powdered". It is hardly to be expected, however, that much advance could be made at a time when little or nothing was known of the cause of disease, nor even of the structure and function of the parts affected.

THE ARABS ; AND THE SCHOOL OF SALERNO

During the next few centuries little progress was made, although the torch of medical learning was kept alive by the Chris-

tian Church and by the Arabian physicians of the Moslem Empire. Neither of those two channels could be called a path of medical progress, as both discouraged the study of human anatomy, a study which was essential if further advance was to be made. Nevertheless, the early Christians preserved with great care the ancient medical classics, and if they did not add to the knowledge they at least perpetuated it. In many an early monastery monks were busily engaged in copying manuscripts. Moreover, as the care of the sick was one of the first principles of Christianity, most monasteries were equipped with a herb garden for the production of vegetable remedies, and some of the earliest hospitals were founded by the Christian Church. The Arabs, within the bounds of the Moslem Empire, which at one time extended from Persia in the East along the North African coast across to Spain and over the Pyrenees, not only preserved and translated into Arabic many medical manuscripts which might otherwise have been lost, but counted among their number some great pioneers whose names are still familiar, as for example, Rhazes and Avicenna, Abulcasis and Maimonides. The Arabs constructed hospitals at Baghdad, at Cordoba and elsewhere, and they added considerably to the sum of medical knowledge, especially in *materia medica*.

So far as the ear, nose and throat were concerned, those centuries were almost entirely sterile, and even after the Moslem Empire came to an end in the thirteenth century, and the accumulated learning passed to Europe by the gateway of Salerno, this state of affairs remained unaltered. One need only read that famous literary product of the School of Salerno, the "Regimen Sanitatis Salernitanum", which existed in numerous manuscripts, and later in some 300 printed editions, to realize that hardly any real advance had been made since the days of Hippocrates and of Galen. The following extract is from the translation by Sir Alexander Cooke (1840):

Our hearing is a choice and dainty sense,
And hard to mend, yet soon it may be marred.
These are the things that breed it most offence
To sleep on stomach full, and drinking hard :
Blows, falls, and noise, and fasting, violence,
Great heat, and sudden cooling afterward :
All these, as is by sundry proofs appearing,
Breed tingling in the ears, and hurt our hearing.

THE REFORM OF ANATOMY

It is to the writings of the medieval anatomists that we must look for the first ray of brightness in the Dark Ages. The practice of dissection appears to have arisen first in Bologna towards the end of the thirteenth century, and to have developed from the post-mortem examination which was ordered in cases of death under suspicious circumstances.

The first anatomical textbook was the "Anathomia" of Mondino de Luzzi (Mundinus), written in 1316. As the entire process of dissection was completed within four days, this allowed little time for such refinements as the structure of the ear or throat. The heart was said to consist of three chambers or ventricles, and the brain under the control of a red worm (which we now recognize as the choroid plexus). One of the most distinguished pupils of Mondino, at Bologna, was the French surgeon, Guy de Chauliac (1300-1367); he was a sound surgeon who showed some originality and reproached his predecessors for "following each other like cranes". He insisted on the importance of anatomy as the basis of surgery, and he may have been the first to use an ear speculum, in order to facilitate the entrance of sunlight into the meatus during attempts to extract a foreign body. He considered the ethmoid as part of the frontal bone, described nasal diseases as "humoral, or fleshy, or crusty", and treated them by sniffing up water in which was dissolved soothing or astringent drugs. Quinsy he treated as follows : "The abscess having matured, one first tries to incise it with a lancet, if it is to be seen, and the mouth is rinsed out with parsley or with some other of the usual detergents. If, however, it is so far within as not to be seen, it should be broken with the finger-nail or by rubbing with something if possible." His description of other diseases are in the main repetitions of the Greeks and Arabians.

The Renaissance began its work of enlightenment in the field of art. Artists looked to anatomists for guidance, but the anatomists were still slaves of tradition. Thus it happened that some of the bolder artists did not hesitate to exchange brush for scalpel in order to explore the human body for themselves. Greatest among them was Leonardo da Vinci (1452-1519), the versatile genius who not only foretold aviation and modern methods of warfare, but also made discoveries in anatomy and was the first to depict accurately the heart, the ventricles of the



FIG. 4
Andreas Vesalius (1514-64)



FIG. 5
Gabriel Fallopius (1523–62)



FIG. 6
Bartolomeus Eustachius (1520–74)

brain, the maxillary and frontal sinuses, and many of the blood-vessels and muscles. His anatomical drawings, many of them in the Royal Library at Windsor and published only recently, have a fidelity that has never been excelled. The naturalistic movement which he represented made the work of Vesalius possible.

It was Andreas Vesalius (1514-64), by the publication in 1543 of his great work "*De humani corporis fabrica*", who truly reformed anatomy. Some of his magnificent woodcuts have been attributed to Titian (1477-1576), and certainly Titian painted a portrait of Vesalius, now in the Pitti Palace. The time was ripe for change, and Vesalius corrected many of the age-long errors of Galen—the multi-lobed liver, the segmented sternum and the horned uterus. Appointed to the Chair of Anatomy at Padua while still in his twenties, he set himself to describe what he actually saw. He insisted on the importance of personally dissecting the human body (which had been left to barbers and servants by his predecessors and contemporaries) as compared with the mere copying of the anatomical writings of the Greeks and the Arabians, and pointed out that many of the errors of Galen arose through his having dissected animals only, and not the human body. To Vesalius we owe the names atlas, vertebra, choanae and mitral valve. He was the first to give an accurate description of the malleus and incus—the stapes was unknown until Ingrassia of Naples discovered it a few years later; the malleus Vesalius compared to the femur, the incus to a molar tooth; the tympanum he called "pelvis", and he also described the oval and round windows, fenestra anterior and fenestra secunda vel posterior, though he had no clear knowledge of the labyrinth. He described the maxillary, frontal and sphenoidal sinuses, and declared that they contained nothing but air. He followed Galen in saying that the larynx had three cartilages, but showed that when the membranes were removed there were two arytenoid cartilages as well—the epiglottis was not accounted a laryngeal cartilage, and Vesalius assumed that it prevented fluids from entering the larynx. The work of this great pioneer was crowded into three or four short years, and of the latter part of his life little is known. He left Padua at the age of 30, lived for a time as court physician to the Emperor Charles V, and died in 1564 after being shipwrecked on the Isle of Zante during a pilgrimage to the Holy Sepulchre.

While Vesalius was at Padua, the Chair of Anatomy at Rome was held by one whose name is familiar to every otologist, Barto-

lomeus Eustachius (1520-74). The work of Eustachius was not published during his lifetime, otherwise it might have rivalled that of Vesalius. It remained unnoticed until the eighteenth century, when the copper plates of the illustrations were discovered in the Vatican library. Nevertheless, his book on the ear, "Epistola de Auditus Organis", appeared when he was at the height of his fame, in 1562, and is probably the earliest work to deal exclusively with the ear. The structure on which his reputation chiefly rests, the Eustachian tube, was known to the Greeks and is mentioned by Aristotle. Nevertheless, Eustachius was one of the first to describe accurately its structure, course and relations. He compared the tube to a quill pen and he divided it into bony and cartilaginous parts, the latter lined by mucous membrane similar to that of the nasal cavity, but he did not hazard an opinion as to its function. His account of the anatomy of the larynx is much more detailed and accurate than that of Vesalius.

Another name which is familiar to otologists is that of Gabriel Fallopius (1523-62), who succeeded Vesalius at Padua. To him we are indebted for such names as cochlea, labyrinth, velum palati and tympanum. He also described and named the chorda tympani, the trigeminal nerve, the auditory nerve and the glossopharyngeal nerve. In describing the passage known as the aqueduct of Fallopius (the facial canal), he stated that he gave it that name from its resemblance to a water-pipe. Fallopius attacked the traditions of Galen even more vigorously than did Vesalius. He was a surgeon as well as an anatomist, and left on record a description of his treatment of aural polypus: the external auditory meatus was to be protected by a leaden tube, and the growth was destroyed with sulphuric acid. In spite of his anatomical knowledge, Fallopius regarded purulent discharge from the ear as "excrement of the brain", and he advised that it be treated by blowing in various powdered drugs rather than by syringing. Fallopius is also an important figure in rhinology, for he invented the wire snare for the removal of nasal polypi. He writes: "I take a silver tube which is neither too broad nor too narrow, and then a brass or steel wire, sufficiently thick, preferably the iron wire from which harpsichords are made. This I place in the tube, so that from this wire a loop is made at one end of the tube by which, used in the nares, I remove the polypi."



W. L. van der Horst fecit 1620

VOLCHERUS COITERUS GRÖNINGI
Frisius D. Medicus Chirurgus et Anatomicus
Excellentissimus Physician Reipubl Noricorum
Ordinarius Anno Christi 1575. Et aet 43 Obiit d' 1600.

FIG. 7
Volcher Coiter (1534–1600)



FIG. 8
Fabricius ab Acquapendente (1537-1619)

EARLY TEXTBOOKS OF OTOTOLOGY

Volcher Coiter (1534-1600), a native of Gröningen, Holland, was a pupil of Fallopius who made noteworthy observations on the anatomy of the ear and whose work, "De auditus instrumento" (1572), might even be regarded as one of the first textbooks of otology, although it contains nothing new in its seventeen chapters and is simply a compendium of all the available knowledge of that day regarding the anatomy and physiology of the ear. Coiter, who became medical officer to the town of Nuremberg, was the first to study comparative anatomy on a large scale, and he deserves to rank high among the great anatomical pioneers. He described very clearly the tympanum, the ossicles, the Eustachian tube, the cochlea, the auditory nerve and other structures. Moreover, he gave an account of current views regarding the physiology of hearing. The main function of the tympanic membrane, he tells us, is to protect the middle ear and to preserve the purity of the contained air (*aer implantatus*). The sound was conducted by this "implanted air" to the cochlea. This cavity also contained air and acted like a resonator, increasing the sound, which then impinged on the ramifications of the auditory nerve. Coiter appears to confuse bone conduction with air conduction by way of the Eustachian tube, consequently a deaf person may hear better with the mouth open, and the sound of a musical instrument becomes more audible when it is held between the teeth.

The next work on otology, in order of time, was "De oculorum et aurium affectionibus paelectiones", published in 1584 by Hieronymus Mercurialis (1530-1606). It may indeed have been the first clinical manual of otology, as the treatise of Coiter dealt only with the structure and function of the ear. Mercurialis had an enormous practice in Bologna and was a very versatile practitioner, as he also wrote the first treatise on diseases of the skin and one of the first on paediatrics. The volume on the ear, just mentioned, shows that the author was, for the most part, concerned with treatment; that his treatment was empirical is shown by the vast variety of medicaments he used, including honey, sea-water, ants' eggs boiled in oil, oil of mustard and the juices of many plants. Such remedies savour of the Middle Ages rather than of the Renaissance, nevertheless Mercurialis must be given credit for his work as one of the first exponents of the practice of

otology. A few years later those who studied the eye and ear had extended their field to include the throat, if one may judge from the titles of two volumes which appeared in the year 1600 and which may now be briefly noticed. "De visione, voce et auditu" was the work of Fabricius, known as Fabricius ab Acquapendente (1537–1619), his name being generally linked thus with that of his birthplace, the little town of Acquapendente. He was a pupil of Fallopius, whom he succeeded, though not directly, in the Chair of Anatomy and Surgery at the University of Padua. In his book he not only describes the structure of the ear, but also discusses why the ears are situated on the head, why the pinna faces forwards, why its upper part is the broader and why not movable. The section on treatment includes advice on the removal of foreign bodies ; for this he recommends a small hook, adding that great care must be taken to avoid injury to the tympanic membrane.

Another book, with a title almost identical with that of Fabricius, was published in the same year by another Italian anatomist, Julius Casserius (1561–1616), who succeeded Fabricius as professor at Padua in 1604, and who numbered among his English pupils William Harvey. "De vocis auditusque organis historia anatomica" (1600) is a work of peculiar interest to the student of comparative anatomy, as Casserius had investigated the structure of the ear in many domestic animals, such as the pig, sheep, horse, dog and cat, and in various birds and fishes. Many artistic and wonderfully accurate illustrations add to the value of the book. His description of the structure of the labyrinth was more exact than that of any previous author, although he fell into the old error of regarding the facial and auditory nerves as branches of one nerve, "in order to preserve a sympathy between the ear and the larynx". Cecilio Folio (1615–60) also gave an accurate description of the middle ear with the round and oval windows and the ossicles, and of the semicircular canals and the cochlea, in his "Auris internae nova delineatio", published at Venice in 1645.

THE EARLY HISTORY OF TRACHEOTOMY

Tracheotomy dates back to Galen and Aretaeus, both of whom refer to cutting the trachea, and Paul of Aegina has a chapter on "laryngotomy". Nothing more is heard of the operation until the Arab physicians Rhazes, Avicenna and

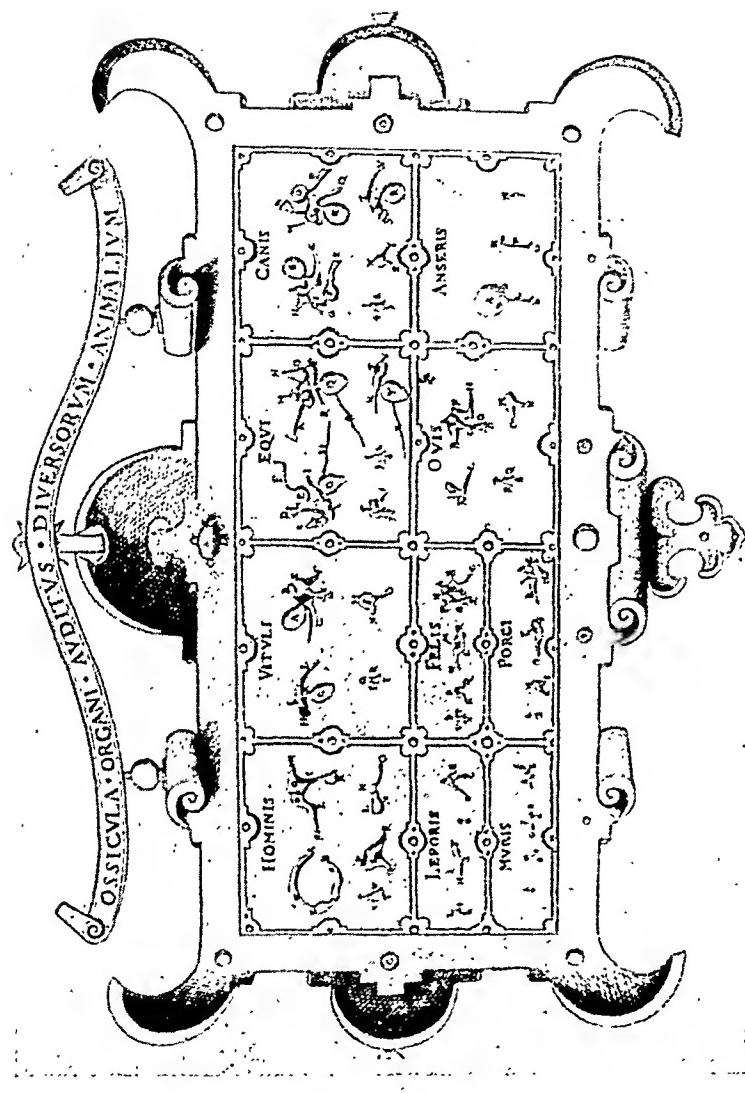


FIG. 9
The auditory ossicles in various animals—an illustration from the "Historia Anatomica" of Julius Casserius (1600)

TAB. XXII. DE LARYNGOTOMIA.



FIG. 10
Early Illustration of Tracheotomy
(From the "Tabulae Anatomicae" of Julius Casserius, 1627)

Avenzoar each describe it, but apparently they never personally performed it. The best description is by Fabricius, who wrote : " Of all the surgical operations which are performed in man for the preservation of his life by the physician, I have always judged to be the foremost that by which man is recalled from a quick death to a sudden repossession of life, a feat which raises the surgeon nearest to the level of Aesculapius ; the operation is the opening of the aspera arteria, by which patients, from a condition of almost suffocating obstruction to respiration, suddenly regain consciousness, and draw again into their heart and lungs that vital ether, the air, so necessary to life, and again resume an existence which had been all but annihilated ". Fabricius went on to review the dispute of former authors as to its utility, and stated that it is useless when the lungs are affected and the whole trachea is full of material. " It is justifiable, in short, when the obstructing matter is only in the larynx above the place of incision ; when below, it is to be refrained from." Fabricius was the first to criticize the transverse skin incision employed up to his time and advised that it should be made vertically over the third and fourth tracheal cartilages. He also recommended the use of a small, straight and short cannula with two wings at its outer ends to prevent it from slipping into the trachea.

In spite of the thought which Fabricius devoted to tracheotomy he never performed it, any more than did his pupil Casserius, who illustrated the operation. Pietro de Abano (1350–1416), one of the earliest occupants of the Chair of Medicine at Padua, devoted a considerable amount of space in his writings to arguing the propriety of performing laryngotomy, but his interest was entirely literary and he had no experiences of his own to record. Antonio Musa Brasavola (1490–1554) was apparently the first person actually to perform laryngotomy, in 1546 ; he is quoted as having said, " When there is no other possibility, in angina, of admitting air to the heart, we must incise the larynx below the abscess ". The second was Sanctorius (1561–1636), who made use of a trocar, leaving the cannula in the wound for three days. Next comes Nicolas Habicot (1550–1624) in 1620, who had four successful cases, and described the operation in his " Question Chirurgicale par laquelle il est démontré que le Chirurgien doit assurément pratiquer l'opération de la Bronchotomie, vulgairement dicté Laryngotomie ou perforation de la flûte ou tuyau du poumon ". With Habicot the operation becomes a standard.

procedure. The first appearance of the word "tracheotomy" is in the "Libri Chirurgiales XII" of Thomas Fienus (1567-1631), Professor of Medicine at Louvain, which was published in 1649.

DISEASES OF THE NOSE AND THROAT

The physicians of the Middle Ages were familiar with uvulotomy and tonsillotomy and the removal of nasal polypi by forceps and knife or by the knotted string method. The cautery was employed in the treatment of all sorts of diseases of the nose and throat. Judging from the medical literature of the time, certainly in the latter half of the fifteenth century and probably even before the return of Columbus and his sailors from America, syphilis was prevalent throughout Europe. It was confused with other diseases and, in fact, it is only a hundred years since syphilis, tuberculosis and cancer of the throat were clearly differentiated, and the diagnosis remained uncertain long after that. Sunken noses and perforations of the soft palate are frequently described in medical books of the Renaissance, and various prosthetic devices were employed to make good the defects, including plastic operations on the nose.

Petrus Forestus (1522-97) mixes good modern with bad traditional treatment in his voluminous "Observationum et Curacionum Medicinalium Libri" (1591), devoting 300 pages to diseases of the nose and throat. He writes with reference to loss of smell : "If it is from ethmoidal obstruction, or from the humour discharged from a catarrh, the latter must first be cured. If from flesh growing within the nose, or from a wart or a haemorrhoid, it is to be cured by the surgeons by operation, either with a cutting instrument or cautery or snare. But if from an abundance of humours filling the ventricles of the brain or obstructing the sieve-like openings, it is to be carried off by the letting of blood, or by purging." He treated and claimed to cure ozaena by copious nasal douching with perfumed white wine in which were dissolved cypress, roses and myrrh, and he also used silver nitrate and alum rubbed up with honey and applied with a probe. Fabricius treated ozaena (which was doubtless confused with syphilis) as follows : "An iron cannula is to be inserted in the nostril, so long that it will reach the end and equal the length of the ulceration and occupy the cavity of the nostrils ; through this a glowing hot instrument is to be introduced which, however, should not

Fungul de nare
sic incidunt



FIG. 11

An Operation for Nasal Polypus (Fungus de Nare) in the Middle Ages

From MS. Harleian No. 1585, fol. 186. Reproduced in Joseph Strutt's "Horda Angel-Cynnan" (The Treasure of the Anglo-Saxons), Pl. XXXIII, 1775

reach beyond the cannula ; it should be so done that the hot iron heats the tube, and through this the nasal tissues and the ozaena ; it is not intended that the nose should suffer pain from this heat, but only that the ulcerated part should be heated to a point short of pain (*citra dolorem*) in one having a good tolerance. This being perceived the cannula may be taken out of the nostrils, the secretions cleaned off and then replaced."

Epidemics of what appears to have been diphtheria begin to be described in the sixteenth century, though the disease may have been confused with scarlet fever, more virulent then than today. Ludovicus Mercatus, physician to Philip II and Philip III of Spain, who died in 1599, described an alarming membranous condition of the throat and how a child bit his father's finger when he was attempting to remove the membrane, and the father died of the same disease two days later. Scarlet fever can first be clearly recognized in the writings of Gian Filippo Ingrassia (1510-80), who called it " rossalia ".

Inflammations of the throat were common and are described under the familiar terms cynanche, paracynanche and cynanche with phlegmonous erysipelas, and were treated with the old traditional remedies, such as the ashes of a nestling swallow and the drinking of urine, accompanied by bleeding and cupping. As regards cancer of the throat, while Aretaeus does refer to malignant disease of the throat and Galen describes a malignant ulceration of the throat, the Middle Ages lack further records.

CHAPTER IV

THE SEVENTEENTH AND EIGHTEENTH CENTURIES

THE seventeenth century was an era of eager intellectual activity in all branches of art and science. The Renaissance had taken a long time to reach Britain, and the century was well advanced before the full benefit of the new learning was experienced. A necessary prelude to scientific discovery was the reform of philosophy by such brilliant thinkers as Francis Bacon (1561–1626) and René Descartes (1596–1650). Bacon, a man of great learning, revived the Platonic method of reasoning, and urged men to think for themselves, to base their knowledge on observation and experiment, and to hold fast to facts. Descartes, a few years later, enunciated his view of man as a machine, a view peculiarly attractive to medical men of the iatrophysical school.

In science, Galileo focused attention upon physical methods, his great scheme of research coming into being when, in his student days, he watched a swinging lamp in the cathedral of Pisa, and conceived the principle of the pendulum in recording time. That was in 1581, and at the turn of the century (1600) there appeared the first book on physical science to be published in England. This was “*De Magnete*”, by William Gilbert of Colchester, a work which earned for Gilbert the title of the “Father of Electrical Science”. Robert Boyle laid the foundation of modern chemistry by the publication in 1661 of his “*Sceptical Chymist*”, and Robert Hooke produced his remarkable account of the revelations of the microscope, entitled “*Micrographia*” (1665). In all the enlightened countries scientific societies came into being. In Rome the Accademia dei Lincei was founded in 1603, in Paris the Académie des Sciences appeared in 1666, while in London the Royal Society began with Boyle, Wren and a group of young scientists in 1645 and received a Royal Charter from King Charles II in 1662. The Royal Society published the greatest of all works on physical science, Newton’s “*Principia*”, in 1687, when Samuel Pepys was President, and the collection owned by the Royal Society ultimately formed the nucleus of the British Museum.

The most eminent medical discoverer of the period was William Harvey (1578–1657), whose discovery of the circulation of the blood was the foundation of scientific physiology and changed the whole aspect of medical practice. By animal experiments and by induction he showed that the heart acted as a pump in propelling the blood through the arteries, and then that the velocity and quantity of the blood required that it should return to the heart by the veins—though he explained the motor power of the heart as due to its being the seat of the soul. Harvey's little book “*Exercitatio Anatomica De Motu Cordis, etc.*” (1628) is perhaps the most important of all medical classics. Harvey never saw the capillaries; he presumed their existence, and it was left to Marcello Malpighi of Bologna, who was born in the year of the publication of “*De Motu Cordis*”, to complete the chain of evidence by demonstrating the network of tiny vessels in the frog's lung.

THE PARACUSIS OF WILLIS

Among the galaxy of questing youths who founded the “Invisible College” which became the Royal Society was Thomas Willis (1621–75), whose work is of great significance in the history of otology. Willis became Professor of Natural Philosophy at Oxford in 1660, and later he conducted a large practice as a physician in London. His principal work, “*Cerebri Anatome*”, was published in 1664 and was illustrated by Sir Christopher Wren, who drew the first representation of the circle of Willis, the arrangement of arteries at the base of the brain. In this account of the anatomy of the brain Willis alludes to the 7th and 8th nerves: “The seventh conjugation of nerves is employed about the sense of hearing. Of this pair are noted two processes, the one soft, the other hard, which indeed seem two distinct nerves . . . agreeing in a common respect for use and action. For whilst one Nerve performs the act of hearing, the other supplies some requisites whereby that act may be better performed: wherefore we shall not strive against the common description of the pair, by which it is taken for one. The Auditory nerve, properly called the soft branch, is carried into the passage of the stony bone, where, entering the den, destined for the receiving the sound, which is on this side the snail-like winding and the drum, it so infolds itself into the most thin membrane wherewith the den is covered, that as often as the air implanted in that cavern is moved

by the stroke of the external air made upon the drum, this impression striking the membrane and stirring up as it were an undulation of the Animal Spirit, is forthwith carried towards the common sensory by the passage of the nerve there implanted."

The opinion of Willis has been quoted in full, as it conveys so well the current knowledge of that time regarding the physiology of hearing. It was in a later publication that Willis made his well-known contribution to the physiology of hearing, in a work entitled "De Anima Brutorum" (1672), later translated into English as "Two discourses concerning the Soul of Brutes, which is that of the Vital and Sensitive of Man". Chapter xiv is devoted to the sense of hearing. Willis explains how "sonorific particles diffused through the air strike upon the drum", and he traces the process thus: "Passing by the winding passage, the sound is much strengthened by frequent strikings and refractions. Nigh to the inmost recess of the Den is placed a thin membrane, like a drum, and about it, three little bones. These parts soften the sensation ere it reaches more delicate parts." Willis appears to have regarded the membrane and ossicles as a means of protecting the inner ear against loud sounds. He advances the view that when the tympanic membrane was destroyed the sound was conveyed by the Eustachian tube, "when the Drum is spoiled, the sensible impression is carried by the open passage at the Palate". Willis also recognized the division of the cochlea. He writes: "There are two shells, the former being nigh the oval hole is lessened by degrees, and from the very little hole at the end, enlarged by degrees". He infers that by the mechanism "every impression is increased and directed to the ends of the sensible nerves, in just proportion and dimension".

In the same chapter the familiar symptom known as the paracusis of Willis, or hearing better in a noisy environment, is described as follows: "We meet with a certain kind of deafness in which those affected seem wholly to want the sense of hearing, yet as soon as a great noise as of great guns, bells, or drums, is made near to the ears, they distinctly understand the speeches of bystanders, but this noise continuing they presently grow deaf again. I heard from a credible person that he once knew a woman though she were deaf, yet so long as a drum was beaten within her chamber, she heard every word perfectly: wherefore her husband kept a drummer on purpose for his servant, that by that means he might have some converse with his wife."

THE PIONEER WORK OF DUVERNEY

The little book by Duverney, "Traité de l'organe de l'ouïe", is generally regarded as the first monograph to be published on the subject of otology. It certainly was the first book to contain an account of the structure, function and diseases of the ear, as the other early works, already mentioned, are for the most part devoted to anatomy. Moreover, Duverney's book (1683) was one of the first medical works to be written in the native language of the author rather than in Latin. It achieved a wide popularity in its original form and in the German (1732) and English (1748) translations, despite their late appearance. Modern writers might well ponder the words of the preface : "Although I do not pretend that this work is entirely perfect, I hope at least, that the reader may here find something which has not been already described".

Joseph Guichard Duverney (1648-1730) was well known throughout the civilized world as a keen anatomist and an accurate observer, who became Professor of Anatomy in Paris in 1679. It was his intention to write a work dealing with all the organs of sense, but only the book on the ear was produced. The treatise is small, but is a model of clear exposition, and the illustrations might well be used for teaching even today. Duverney was the first to show that the bony external meatus developed from the annulus tympanicus, and that the mastoid air cells communicated with the tympanic cavity. He erroneously described the external ligament of the malleus as a muscle, the counterpart of the tensor tympani, but it may be noted that before that time as many as six intra-tympanic muscles had been described. He believed that the tension of the tympanic membrane was regulated by the controlling muscles and that it varied according to the pitch of the note heard, this being in fact a mechanism of accommodation similar to that of the iris of the eye. In like fashion he held that the stapedius attuned the tension of the stapes to sounds of varying pitch. He corrected an age-long error by stating that the Eustachian tube was not an avenue of breathing or of hearing, but was simply the channel through which the air of the tympanum was renewed. He also correctly explained the mechanism of bone conduction.

Duverney gives a clear and accurate account of the bony labyrinth, although he was unaware of the structure or even of the existence of the membranous labyrinth.. He made noteworthy



FIG. 12
Thomas Willis (1621-75)

TRAITE E L'ORGANE DE LOUIE;

CONTENANT LA STRUCTURE,
les Usages & les Maladies de toutes
les parties de l'Oreille.

Par M. DU VERNEY, de l'Academie
Royale des Sciences, Conseiller, Medecin
Ordinaire du Roy, & Professeur en
Anatomie & en Chirurgie au Jardin
Royal des Plantes.



A PARIS,
Chez ESTIENNE MICHALLET,
rué S. Jacques à l'Image S. Paul.

M. DC. LXXXIII.
AVEC PRIVILEGE DE SA MAESTE:

FIG. 13
Title-page of Duverney's Treatise on the Ear (1683)

advances in the physiology of hearing, and it was he who suggested the theory of hearing which is now usually linked with the name of Helmholtz. Like his predecessors, he assumed that the labyrinth contains air, but he compared the cochlea to a musical instrument, suggesting that the lower tones are perceived by the basal coil of the cochlea, and the higher tones, of more rapid vibration, by the narrower apical portion. According to his theory, the lamina spiralis was the site of the actual organ of hearing, while the semicircular canals acted as amplifiers. The difference between the theory of Duverney and that of Helmholtz is that the latter showed that the high tones were perceived in the lower coil of the cochlea, and so progressively towards the upper or smaller coil in which low tones are perceived, exactly the contrary of Duverney's explanation. The epoch of microscopy had arrived when Helmholtz enunciated his theory, and he recognized that the hearing organ was in the basal membrane and that the semi-circular canals played no part in hearing.

Duverney did not confine his attention to the anatomy and physiology of the ear. He studied aural pathology and sought for a scientific explanation of earache, discharge from the ear, deafness and tinnitus, each of which had been previously regarded as a definite disease and not merely as a symptom. He stated that at post-mortem examinations of infants he frequently found pus in the tympanum even when the brain was normal, and he argued that purulent discharge from the ear was not always an overflow from the brain, as many previous observers had stated. His treatment, however, is mainly empirical and consists largely in the use of various plant juices. Nevertheless, the work of Duverney makes a most notable advance in our knowledge of the ear and its diseases, and although it is hardly possible to regard any one man as the "Father of Otology", the claim of Duverney to such a title is well supported by the evidence.

THE VALSALVA EXPERIMENT

The next noteworthy contribution to otology was made by another whose name, like that of Willis, is a household word in otology. Antonio Valsalva (1665-1723), after dissecting more than a thousand human heads, wrote a treatise on the ear which is worthy to rank alongside that of his contemporary, Duverney. Valsalva's "Tractatus de Aure Humana" was published in 1704,

at Bologna, where he had long been a pupil of Malpighi, the master whom he succeeded in the Chair of Anatomy in 1697. Valsalva, for purposes of description, divided the ear into three parts, the outer, middle and inner ear, and he applied the term "labyrinth" to the entire inner ear. He suggested the use of the terms *scala vestibuli* and *scala tympani*, to replace the misleading use of the words "upper" and "lower" galleries of the cochlea. He was also the first to describe the muscles of the pinna, and to apply the name "Eustachian" to the pharyngo-tympanic tube in honour of Eustachius. Furthermore, he was the first to demonstrate the presence of ankylosis of the stapes at post-mortem examinations : "One day in the cadaver of a deaf person I found the cause of the deafness. The membrane covering the oval window was ossified in such a way that the base of the stapes and the periphery of the window formed a solid piece and the stapes had become immobile." More than a century was to pass before the significance of this observation became apparent.

It is said that Valsalva was the first to examine the tympanic membrane in the living, but in doing so he perpetuated the error of mistaking the notch of Rivinus for a foramen, an error which was current among anatomists even before Rivinus of Leipzig published his thesis in 1717. He also believed still that middle-ear suppuration was secondary to cerebral abscess, and was not the primary lesion. His successor, Morgagni, corrected this error.

The name of Valsalva, however, is most intimately connected in the mind of the otologist with the experiment, method or test which he devised. The procedure consists in performing the act of expiration, blowing out strongly while holding the mouth and nose firmly closed, thus forcing the air to pass into the tympanum by way of the Eustachian tube. There is evidence to show that this method of treating deafness and of expelling foreign bodies from the ear had been used before the time of Valsalva, but it was he who placed the method on a rational foundation. Originally he suggested it as a means of expelling pus in cases of otitis ; later on, it was employed to replenish the air in the middle ear when the Eustachian tube was obstructed. The obvious disadvantage of the method is that it acts more strongly upon the unaffected ear, if the lesion is unilateral.

Valsalva was not only a tireless investigator and an enthusiastic experimenter ; he also carried on a large practice as a physician. Kindly and benevolent, he advocated greater freedom for the

insane, who, in his day, were chained and treated like criminals ; the reform urged by Valsalva was put into action a century later by Philip Pinel of Paris. The name of Valsalva ranks high in medical history, and it is not surprising that a journal devoted to otology, founded by G. Bilancioni and first published in Rome in 1925, was named and still bears the name of " Il Valsalva ". It was Valsalva who first rationalized treatment in otology.

PATHOLOGY ARRIVES ON THE SCENE

Although his successor, Morgagni, is sometimes regarded as the chief pioneer of modern pathology, or rather, of morbid anatomy, it was Valsalva who blazed the trail, making careful observations and correlating clinical symptoms and signs with post-mortem appearances. Morgagni improved upon Valsalva's description of the ear, and to Valsalva he accorded full merit for his monumental contributions. In his " Life and Work of Antonio Valsalva " (1740) he showed his devotion to his teacher whom he so highly revered.

Giovanni Battista Morgagni (1682-1771), when called to be Professor of Anatomy at Padua at the age of 29, was already held in high reputation, a distinction to which he added steadily during the next fifty-six years. It may be said truly that he linked pathology with anatomy on the one hand and clinical medicine on the other. His great masterpiece, " De sedibus et causis morborum ", did not appear in print until 1761, when Morgagni had reached the age of 79. Morgagni owed much to his teacher Valsalva, and many observations recorded in his book were made by Valsalva. Nevertheless, Morgagni was by no means a compiler of other men's work. He gave an elaborate description of the ventricles of the larynx (his name in consequence being attached to them, although they had been described by Galen), and he thought that although they might modify the voice, more probably they acted as reservoirs for mucus to lubricate the vocal cords. He made numerous discoveries in the field of morbid anatomy, and recognized the true nature of those clots within the heart which had formerly been described as polypi. He was the first to state that syphilis could affect viscera. He showed that cerebral haemorrhage was a lesion of the blood-vessels and not of the brain substance. He was the first to prove conclusively that brain abscess might occur as a complication of otitis, and that it was not necessarily the

primary lesion, as had been previously imagined. By these and other observations made during his long and arduous life, Morgagni earned a high reputation and, indeed, he may be regarded as one of the greatest figures in medical history. Nor were his researches confined to anatomy and pathology. He was an authority on archaeology and history, and he found time to study chemistry, zoology, astronomy and mechanics.

THE MYSTERY OF THE LABYRINTH

It is not surprising that the inner ear, with its complex structure, was the last portion to yield its secrets to the enquiring anatomists. The sequence of distinguished Italian investigators was continued by one who should always be remembered as the discoverer of the labyrinthine and cerebro-spinal fluids. Domenico Cotugno, or Cotunni (1736–1822), studied under Morgagni, and became Professor of Anatomy and Surgery at Naples. At the age of 24, in 1760, he published his treatise entitled “*De aqueductibus auris humanae internae anatomica dissertatio*”, in which he proved the existence of fluid within the labyrinth (*liquor Cotunni*). The fluid in the labyrinth cavity had been noted by Pyl, but Cotugno was the first to show that the labyrinth was entirely filled with fluid. His first observation was made in the ear of the horse, and it was subsequently confirmed in the human ear. At that time the existence of the membranous labyrinth was not known, and Cotugno regarded the fluid as “an exhalation from the blood-vessels to protect the nerves which might be injured by constant contact with bony structures”.

The theory of hearing which he enunciated is the first of its kind and is almost in accordance with modern teaching. He correctly described the fibres of the basilar membrane within the cochlea as longest at the apex and shortest at the base, so that his view is similar to that of Helmholtz. Regarding the cerebro-spinal fluid, he writes: “The space between the dura mater and the spinal marrow is filled with water, like the ventricles of the brain, the labyrinth of the ear, the pericardium and other cavities of the body”. Cotugno was among the first to observe that the urine coagulated on boiling in cases of nephritis, and the first to demonstrate the presence of ulcers of the intestinal mucosa in typhoid fever. He also wrote a noteworthy monograph on sciatica.

These important anatomical discoveries of the seventeenth and



FIG. 14
Antonio Maria Valsalva (1665-1723). The Frontispiece to his
“De Aure Humana” (1735)

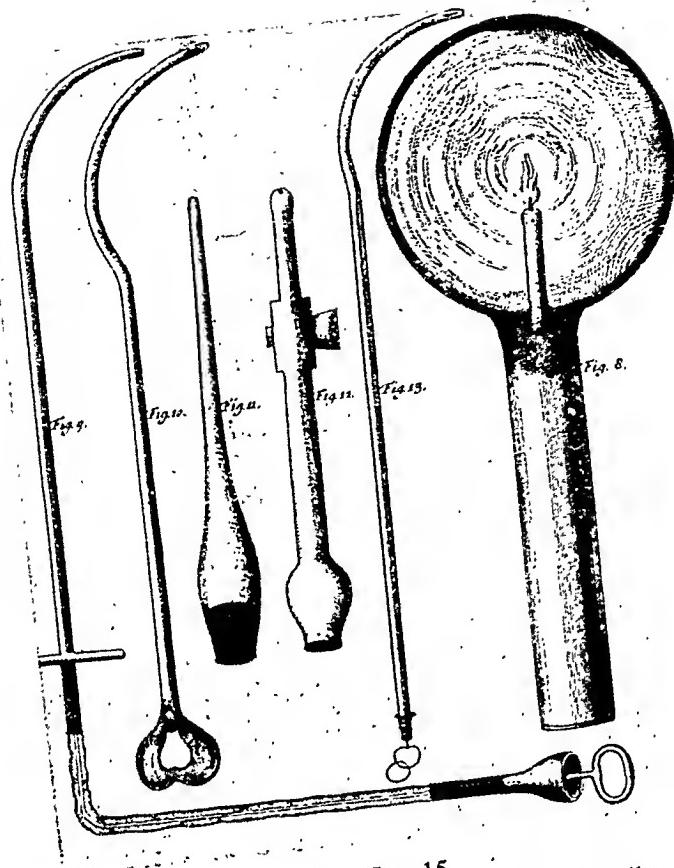


FIG. 15
Eustachian Catheter and Lens with Candle
for Illumination of Ear
Archibald Cleland, "Phil. Trans. Royal Society" (1741)

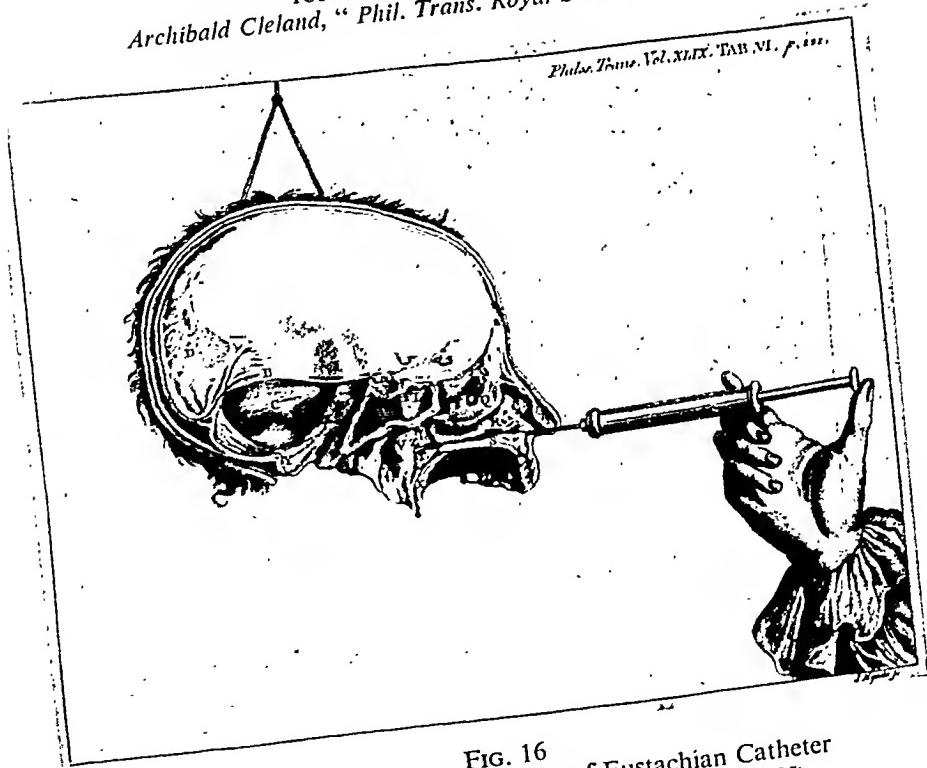


FIG. 16
First Illustration of Mode of Use of Eustachian Catheter
Jonathan Wathen, "Phil. Trans. Royal Society" (1755)

eighteenth centuries culminated in the work of yet another Italian pioneer, Antonio Scarpa (1747-1832), a pupil of Morgagni, who was Professor of Anatomy and Surgery successively at Modena, Paris and Vienna. Scarpa crowned the work of his countrymen in the realm of anatomy by his discovery of the membranous labyrinth. In his "*Disquisitiones anatomicae de auditu et olfacto*" (1789) he described the hearing apparatus in fishes, birds and reptiles, as well as in man. He showed that the round window was capable of acting as a secondary tympanic membrane, a fact which is still accepted. He demonstrated that the membranous labyrinth was virtually a replica of the bony labyrinth within the cochlea and semicircular canals, described the saccule and utricle, and distinguished the fluid contents of the bony and membranous labyrinth as perilymph and endolymph. Nor were his observations confined to the ear. He wrote original treatises on diseases of the eye and on hernia, and devised a shoe for the treatment of club-foot. As an artist Scarpa excelled, and he illustrated his own works with drawings which are correct and clear in every detail. His writing was as exact as his drawing, and he was an excellent latinist and a popular teacher.

THE HISTORY OF THE EUSTACHIAN CATHETER

With the work of Scarpa, the knowledge of the anatomy of the ear was almost complete ; only a few details remained to be added. Certainly the physiology of hearing was ill understood, while the study of the pathology of the ear had scarcely commenced. It was obvious that the problem had to be approached from some new angle if further progress was to be made. Before the eighteenth century the treatment of deafness and of diseases of the ear rested almost entirely upon an empiric basis, and even the remarkable discoveries of the anatomists had not led to any great improvement in methods of treatment. The time was ripe for new methods, and those methods included the use of the Eustachian catheter and the relief of mastoiditis by surgical means. The Eustachian catheter was invented in a strange fashion ; its story parallels that of the laryngoscope, which was introduced more than a century later. Both instruments were invented by "lay" non-medical persons, the laryngoscope by a singing-master and the catheter by a postmaster. In each case Paris was the birthplace of the new instrument.

It was in 1724 that Edmé-Gilles Guyot, a postmaster at Versailles, succeeded in relieving his own deafness by the use of a curved tube passed into the mouth and behind the palate. In describing his invention to the Académie Royale des Sciences of Paris he stated : “La pièce principale en est un tuyau recourbé, que l'on insinue au fond de la bouche derrière et au-dessus du palais, à dessein de l'appliquer au pavillon de la trompe qu'on veut injecter. On en lave au moins l'embouchure, ce qui peut être utile en certain cas.” Thus Guyot, although untrained in medicine, appears to have been aware of the existence of the “trompe d'Eustache”, although it was water or a watery fluid, and not air, that he injected by means of his “tuyau”. Guyot's contribution excited little comment ; the anatomists of his day would not admit that it was possible to syringe out the Eustachian tube by way of the mouth.

No further progress was made until 1741, when a Scottish military surgeon, Archibald Cleland, of General Wade's Regiment of Horse, who had never heard of Guyot's work, recommended that in cases of deafness, when Eustachian obstruction is suspected: “The passage should be lubricated by throwing a little warm water into it by a syringe fixed to a silver tube which is introduced through the nose into the oval opening of the duct at the posterior part of the nares. . . . The pipes of the syringe are made small, of silver, to admit of bending them, as occasion offers, and for the most part, resemble small catheters. They are mounted with a sheep's ureter, the other end of which is fixed to an ivory pipe which is fitted to the syringe, whereby warm water may be injected, or they will admit to blow into the Eustachian tube and so force air into the barrel of the ear and dilate the tube sufficiently for the discharge of excrementitious matter.”

Cleland's communication to the Royal Society was entitled “Instruments to Remedy some Kinds of Deafness proceeding from Obstructions to the External and Internal Auditory Passages”. He described a “convex glass”, apparently a large lens, which “will dart the collected rays [of sunlight] into the bottom of the ear”. If the ear is found to be full of wax: “The method of removal is to have a small boiler, and, by tubes of various sizes, the steam is conveyed to the ear, and in a short time the wax will dissolve. . . . Another kind of deafness proceeds from a violent clap of thunder or noise of a cannon. . . . The Membrana Tympani is forced inwards upon the small bones, and so becomes concave outwardly,

and no vibration of sound will be communicated to the drum until the membrane has recovered its natural position. The means to remedy this disorder are, first to oblige the patient to stop his mouth and nose, and force air through the Eustachian tube into the barrel of the ear by several strong impulses, to push the membrane back." Apparently it did not occur to Cleland that the air might be blown in by the catheter which, from his account, he employed only as a means of washing out the Eustachian tube. If the Valsalva method, to which he alludes, should fail, Cleland advises that an ivory tube be exactly fitted to the external meatus, and to the outer end of the tube, suction is applied by the mouth of the surgeon so as to "draw the membrane back, and then the person will hear as before".

A few years later (1755) Jonathan Wathen, a surgeon in Devonshire, described to the Royal Society "A Method proposed to restore the Hearing, when injured from an Obstruction of the Tuba Eustachiana". Wathen makes no reference to the work of Cleland, which may have been unknown to him. He described the Eustachian tube as "two distinct cones, the extremities of which unite, but their bases diverge". He noted that deafness might be due to Eustachian obstruction, and he proceeds to consider how this may be relieved. Wathen refers to Monsieur Guyot's experiment, but he regards that method of washing out the Eustachian tube by the mouth as "quite impossible, as evidently appears to anyone that will give himself the trouble to examine into it. . . . That learned and skilful anatomist, Mr. John Douglas, first demonstrated the possibility of passing the probe through the nose into the Eustachian tube, and to him I freely acknowledge myself indebted for the hint. . . . I first introduced a probe, through the nose, into the tubes of several dead subjects, and having acquired a facility, I did the same on a person that was very deaf: no sooner had I withdrawn the probe, than he said he could hear much better. I had pipes of different sizes adapted to a syringe, and have since injected the meatus internus with much success."

Wathen employed "a little honey in warm water" for washing out the tube, and he described and was the first to illustrate the method of passing the Eustachian catheter by way of the nose. Details are given in his paper of six cases in which the treatment gave relief. Wathen concludes: "The operation is not at all dangerous, neither has it been thought painful by those who

desire to recover their hearing". Apparently the catheter was used in order to syringe the Eustachian tube with fluid and not as a means of inflating the tympanum. The "air douche" and "air press" did not come into use until the nineteenth century.

ARTIFICIAL PERFORATION OF THE TYMPANIC MEMBRANE

Although the anatomy of the ear had been fully investigated before the eighteenth century, it was believed for many years that there existed, normally, in the upper part of the tympanic membrane the membrana flaccida, an opening which was called after Rivinus, who described it, the foramen of Rivinus. It was not until Shrapnell investigated the minute structure of the tympanic membrane that this observation was proved to be erroneous. The mistake was not surprising, as every otologist knows how difficult it is to establish the existence of a so-called attic perforation.

Thomas Willis, in the seventeenth century, had attempted to investigate, in dogs, the result of puncture of the membrane, and Eli, a strolling quack, in 1760 punctured the drumhead to relieve deafness. In 1800 the distinguished London surgeon, Sir Astley Paston Cooper (1768-1841), of Guy's Hospital, hard-working, unaffected, courteous and handsome, noted in two of his patients that partial loss of the membrane caused only a slight diminution of hearing power and did not produce total deafness, as had been popularly imagined. Sir Astley Cooper carried his argument further in the following year, when he suggested that "the deafness which arises from an obstruction of the Eustachian tube" might be treated by puncturing the tympanic membrane. He described in detail four cases in which this had been done; relief was produced in three. The instrument employed was "a trocar and cannula, of the size of a common probe", which was thrust through the antero-inferior part of the membrane. His memoir to the Royal Society, on the treatment of deafness by perforating the tympanic membrane in twenty cases, was awarded the Copley Medal in 1802, a tribute perhaps to the personality of the surgeon rather than to the scientific value of his communication.

Although Sir Astley Cooper was careful to state that the operation was not a panacea for all kinds of deafness, his opinion carried such weight that the method was used by many surgeons, sometimes with little regard to the nature of the deafness. A minute trephine, known as the "aurisector", was invented and

used to punch out from the membrane a tiny disc. As time went on, however, the results were found to be transient only, and the operation was forgotten. It is of interest to note that the operation of paracentesis tympani was practised for the relief of deafness long before it was advised as a means of facilitating drainage in suppurative otitis, just as the mastoid operation, a later development with which we shall presently deal, was recommended as a cure for deafness and tinnitus years before it was accepted in the treatment of mastoiditis.

The first to advise paracentesis, or incision of the drum-head, in acute suppuration of the middle ear, was John Cunningham Saunders (1773–1810), Demonstrator of Anatomy at St. Thomas' Hospital, London. In 1806 Saunders published his work on "The Anatomy of the Human Ear, with a Treatise on the Diseases of that Organ", a book which is illustrated by some beautiful engravings. Saunders was strongly opposed to "the absurd doctrine of refraining from the treatment of ear discharge", and he advised syringing with a solution of zinc sulphate. Tradition dies hard, and one still occasionally encounters the belief that purulent discharge from the ear ought to be favoured rather than suppressed. In those days the eye and the ear were often associated as subjects of study; accordingly it is not surprising to learn that Saunders was the founder in 1805 of Moorfields (Royal London Ophthalmic) Hospital.

EARLY HISTORY OF THE MASTOID OPERATION

Sir Charles Ballance, in his magnificent work on "The Surgery of the Temporal Bone", states that the earliest suggestion of opening the mastoid by operation is found in the writings of the anatomist Johannes Riolanus (the younger), who in 1649 suggested trephining the mastoid as a means of treatment for tinnitus, but who does not appear to have carried his suggestion into practice. The plate (Fig. 18) suggests that mastoid surgery was practised at an even earlier date, but this may have been the opening of a sebaceous cyst. It was not until the eighteenth century that Jean Louis Petit (1674–1750) of Paris carried out what is generally believed to have been the first successful operation on the mastoid for the evacuation of pus. His operation was not simply the enlargement of a persistent fistulous track but a deliberate search for pus in the bone. "I have seen two or three cases", he

writes ; "one died from caries of the mastoid process. I proposed to trephine the mastoid process, but my suggestion was rejected." In another case recovery took place "after the compact layer had been taken away with gouge and mallet" to drain the purulent collection. "These abscesses in the diploe may persist for a long time before reaching a stage at which they cause death ; but from the very first days of their formation they ought to be opened, and we ought not to wait until they have destroyed the bone, for the patient is always in danger, not only because of the pus which does not escape, but because of other accidents which may supervene, and render the disease infinitely complicated and fatal."

Petit relates another case of persistent dull pain in the mastoid region for which operation was at first refused. But, at last, on the 25th day, consent was given and Petit operated, using a trephine : "I had scarcely got through the outer table when there escaped a quantity of foul-smelling serous exudation ; exfoliation took place in due course and the patient recovered". Petit's observations were unfortunately not published until some years after his death, and appear to have excited little comment then.

The next historical account of a mastoid operation was that of Jasser, a Prussian military surgeon, in 1776. A recruit suffered from offensive discharge from both ears, loss of hearing, and periodic attacks of pain. He entered hospital with fever and severe pain in the right ear. "He was bled, purged, blistered and leeched", after the fashion of the day. The pain and discharge nevertheless increased and a swelling appeared in the right mastoid region. An incision down to the bone evacuated only a few drops of pus. Jasser removed part of the bone and found a deep opening which he syringed, when the fluid escaped from the right nostril and much pus poured from the meatus. The patient was relieved of pain and slept soundly for ten hours. In three weeks the wound was healed. Jasser was probably unaware of Petit's work, and he concludes his account by saying : "Perhaps this is no new discovery, but for me it is quite new".

For a time, after this, the operation was misapplied to cases of tinnitus and deafness, and it was an effort to relieve such symptoms by operation which led to the death of the Danish court physician, Baron von Berger, in 1791. The patient was 68 years of age and, having heard of the success of Jasser, he decided that a mastoid operation might cure his deafness or, at least, relieve his tinnitus. Accordingly, the operation was performed on the right side by a



FIG. 17
Sir Astley Paston Cooper (1768-1841)



FIG. 18

An Early Mastoid Operation. Engraving by Van Leyden (1524)
(By courtesy of W. M. Mollison and "Journal of Laryngology and Otology")

surgeon named Kölpin. It is probable that the meninges were injured at the operation—at all events, the Baron died of meningitis twelve days later. After this unfortunate result, in a distinguished patient, the operation fell into disrepute, and although a few bold surgeons performed it, no definite progress was made until surgery became revolutionized in the middle of the nineteenth century by the great twin discoveries of anaesthesia and anti-septics. Neither Wilde nor Toynbee, the pioneers of British otology, whose work we shall review in the next chapter, ever carried out the mastoid operation. The former recommended his classical incision, but went no farther ; the latter wrote that he had never performed the operation, although he would not scruple to do so if the life of the patient were threatened.

THE NOSE AND NASAL SINUSES

Until the middle of the seventeenth century nasal catarrh was still explained, according to the ideas of Galen, as a “ purging of the brain ” and mucus percolated through the bony foramina in the base of the skull. Willis believed in the existence of a nervous fluid which was secreted by the brain, and that the nerves were porous and carried this fluid to the different parts of the body. He writes : “ Within the cavities of the nose there are tubular membranes which contain thickly woven sensile fibres. In these membranes there are a number of slender nerves given off from the mamillary processes through the cribriform plate. . . . Nothing is more certain than that the serous humours are distilled from the nerves like serum from the membranes in swollen joints.” The contemporaries of Willis—even Malpighi—held these beliefs and in fact persisted in adhering to them even after the error had been pointed out to them by Conrad Victor Schneider (1614–80), who published his classical treatise on the membranes of the nose, “ De Catarrhis ”, in 1660. Schneider established that the origin of the nasal discharges could not be in the cranial cavity, and that if such secretions were formed there they could not escape, since neither the cribriform plate nor the nutrient canal of the sphenoid bone nor the lacerated foramina were pervious and, as a matter of fact, no fluid so viscid as mucus was to be found there at all. He described the origin of nasal secretion as in the anterior and posterior nasal mucous membranes, which when normal exude this mucus in moderate amount and when more is exuded “ catarrh ” arises ;

thus the brain was not affected at all in coryza. While Schneider showed that the nasal mucous membrane was itself the source of nasal discharges, he did not discover the microscopic mucous glands in the membrane in which the mucus is formed and from which it comes. To Steno, in 1662, is probably due the credit for first describing them ; he described the larger glands of the mouth and eyes and the "vessels" of the membrane of the nose, which, he said, were of two kinds and existed in the mucous membranes for the purpose of keeping them moist. Richard Lower (1631-91) of Oxford, who first transfused blood from one animal to another, supported the ideas of Schneider in 1671 in a dissertation "On the Origin of Catarrh in which it is shown that it does not come from the Brain". The improvements in the microscope due to Leeuwenhoek (1632-1723) helped Giovanni Santorini in 1724 to be able to describe the glands in the nasal mucosa : "If we wish to demonstrate them most clearly we arrange the membrane, previously cleansed and somewhat macerated under the crystal, and the light being conveniently and adequately arranged for it, we may recognize their number, their size, and their colour. Their size varies indeed, some being a little ovoid, and these are about equal to a grain of mustard."

The first to discuss deviations of the nasal septum appears to have been Quelmaltz, who published a treatise on this subject in 1750, "Programma de Narium earumque Septi Incurvatione". The causes of the obstruction he considered to be pressure upon the nose in difficult labour, falls in infancy, continually pushing the finger into the nose in childhood, and inflammatory conditions. Morgagni, in his "De Sedibus et Causis Morborum", also describes spurs and deviations of the septum, which he sensibly considers to be due to "the too rapid growth of the septum relative to the other bones of the upper jaw, from which reason there necessarily results a curvature". He did not agree that the septum is always inclined to one side or the other, and says that he had seen many straight septa. He has nothing to add on treatment, which, indeed, was not contemplated until the following century.

The etiology of the nasal polypus was ill understood—indeed, the same might be said up to the end of the nineteenth century—and the term was a very comprehensive one, being used by Van Meckren (in 1682) to describe a rhinolith, a piece of wood covered with granulations which a patient of his expelled from his nose.



FIG. 19
Nathaniel Highmore (1613-85)

TABXVI

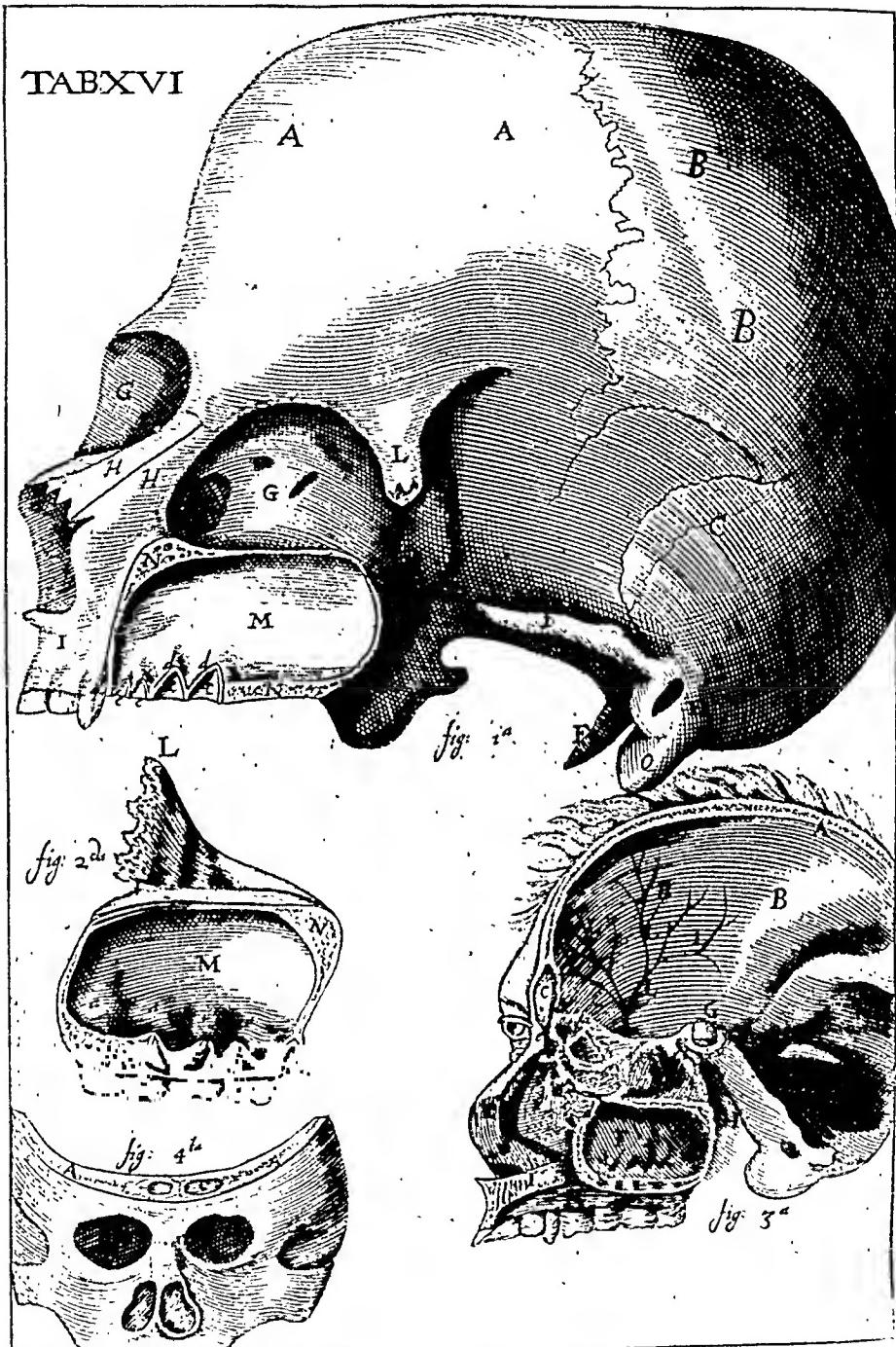


FIG. 20
The Maxillary Sinus or Antrum of Highmore, as depicted in Highmore's
“Disquisitio Anatomica” (1651)

St. Hilaire in 1698 thus describes nasal polypus : " When this excrescence is hard and is not pendent they call it sarcoma, which is a great, round tumour, which has not a root like the polypus ; moreover, sarcoma always commences at the lower part of the nostrils, and the polyp takes its origin in the osseous lamellae at the root of the nose. In order to well understand the cause of this excrescence, it is necessary to observe that the internal membrane of the nose is very thick and spongy, and is bathed in a sticky, viscid humour, and its porosities are so arranged that it only gives passage to those parts of the blood which are the thickest and most likely to produce excrescences. All these causes joined together contribute greatly to the generation of polypi. . . . The polyp indeed may also be engendered by an acrid lymph, which erodes the glands and the channels of the internal membrane of the nose in such a manner that the nutrient juice, becoming infiltrated by the ulceration of this membrane into the interstices of its fibres, coagulates there and forms, little by little, those excrescences which they call polypi. One may again attribute the cause of these excrescences to the little glands of the membrane, which, in dilating, become joined together and form that which we call polypus."

Hermann Boerhaave of Leyden (1668–1738) accounted for the formation of a nasal polypus by supposing that the nasal passages and the sinuses becoming clogged with inspissated mucus, the mucous membrane was unable to discharge its humours ; and Juncker in 1721 said that according as the moon filled or waned, the polypi of the nose increased or decreased in size, " hence it may be concluded it is best to attack the polyp in the waning of the moon ". Morgagni is, however, more intelligent regarding polypi and, referring to cases of polypi of the maxillary antrum, writes that they are much more frequently seen, at post-mortem examination, outside rather than inside the sinuses.

Although Vesalius described the maxillary, frontal and sphenoidal sinuses and said they contained nothing but air, and Fallopius pointed out that they were not present in children until they arrived at maturity, the pathology and the surgery of the nasal sinuses dates from the mid-seventeenth century. Nathaniel Highmore (1613–85) described the maxillary sinus or antrum, which bears his name, in 1651, in recording a case of suppuration in the antrum caused by an abscess of a canine tooth in the upper jaw and relieved by pulling the tooth. The patient, after the extraction of the tooth, thrust a silver bodkin into the empty socket

and " was exceedingly frightened to find it pass, as it did, almost to her eyes. And upon further trial with a small feather stripped of its plume, was so terrified as to consult the Doctor and others about it, imagining nothing less than that it had gone to her brain " —the feather having doubled up in the antrum. Highmore was a friend of William Harvey's, and is said to have been the first to employ the microscope in the study of anatomy. Antonio Molinetti in 1675 wrote as follows : " In a patient suffering from terrible pain, they made a crucial incision on the jaw, and with the crown of the trephine penetrated into the antrum of Highmore, which was the seat of the abscess ". William Cowper wrote a chapter on diseases of the nose in Drake's " Anthropologia Nova ", published in 1707, and described how he operated on an infected antrum, " being convinced it might be done without hazard to the patient. After the foremost Dens Molaris was taken out, not finding an aperture from its alveolus into the antrum, which in other instances I have seen happen, with a convenient instrument I bored the hole of the alveolus into the Antrum Genae, whereby the pus, which before lay in the antrum, ran out, and the medicines that were daily injected by this aperture passed into the nostrils, whereby the patient was cured, though this disease had continued, with a vast flux of stinking matter daily from the nose, for more than four years before the operation." The anatomists of the eighteenth century, of whom John Hunter was the chief, were more concerned with the olfactory nerve than with the nasal sinuses (see Fig. 21).

EARLY LARYNGOLOGY

Although Boerhaave in 1668 described a " cancerous angina " and Morgagni in 1732 described two cases of cancer of the larynx, in the eighteenth century laryngology was concerned largely with descriptions of malignant sore throats and diphtheria, a disease which was very prevalent and fatal. John Fothergill (1712-80), the famous wealthy Quaker physician, philanthropist, friend of the American colonists and botanist, of London, published his classical " Account of the Sore Throat attended with Ulcers " in 1748 ; but although this disease has been called diphtheria, it may well have been a malignant type of scarlet fever rather than diphtheria. " It generally comes on ", writes Fothergill, " with such a giddiness of the head, as often precedes fainting, and a chillness or shivering like that of an ague-fit : this is soon followed

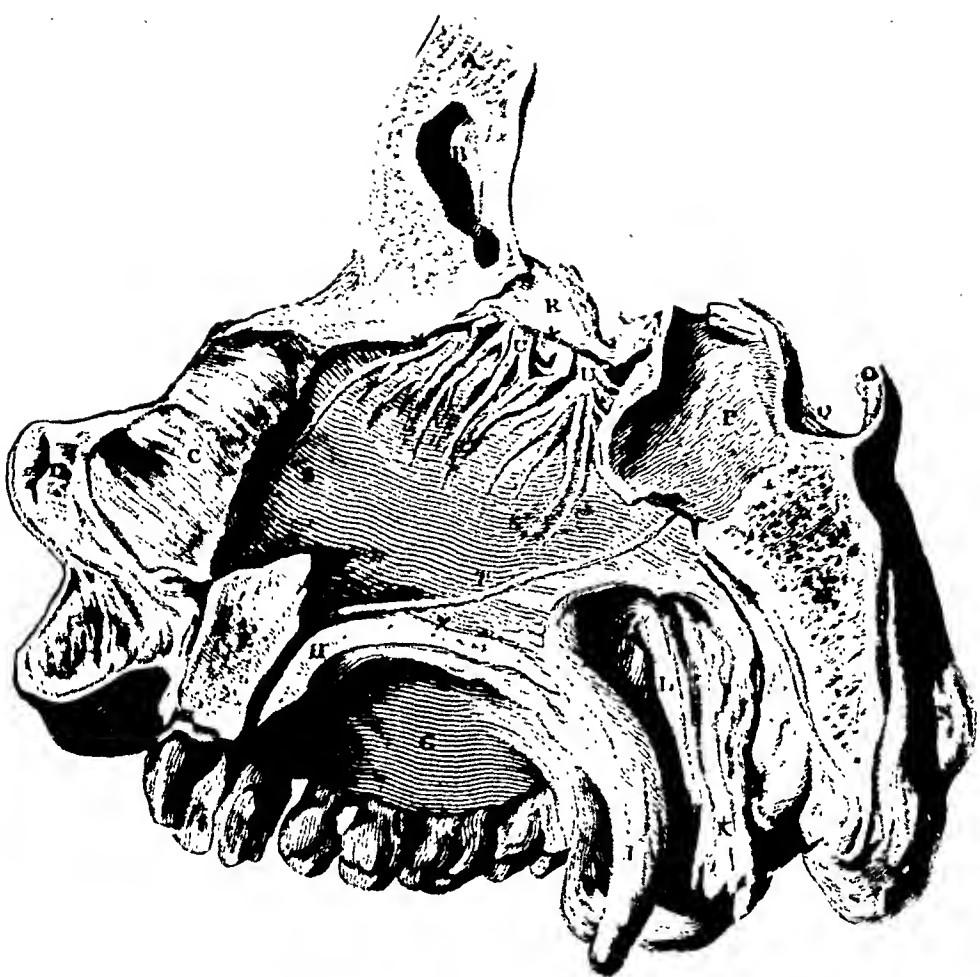


FIG. 21
Dissection of the Olfactory Nerve by John Hunter



by great heat ; and these interchangeably succeed each other during some hours, till at length the heat becomes constant and intense. The patient complains at the same time of an acute pain in the head, of heat and soreness, rather than pain, in the throat, commonly of great sickness, with vomiting, purging, or both. The face soon after looks red and swelled, the eyes inflamed and watery ; with restlessness, anxiety and faintness. . . . If the mouth and throat be examined soon after the first attack, the uvula and tonsils appear swelled ; and these parts, together with the velum pendulum palati, the cheeks on each side near the entrance into the fauces, and as much of them and the pharynx behind as can be seen, appear of a florid red colour. This colour is commonly most observable on the posterior edge of the palate, in the angles above the tonsils, and upon the tonsils themselves. Instead of this redness, a broad spot or patch, of an irregular figure, and of a pale white colour, is sometimes to be seen, surrounded with a florid red ; which whiteness commonly appears like that of the gums immediately after having been pressed with the finger, or as if matter ready to be discharged was contained underneath. . . . A great number of small pimples, of a colour distinguishably more intense than that which surrounds them, appear on the arms and other parts. . . . As the skin acquires this colour the sickness commonly goes off, the vomiting and purging cease of themselves, and rarely continue after the first day. The appearance in the fauces continues to be the same, except that the white places become of a more opaque white ; and it is now discoverable, that what at first might have been taken for the superficial covering of a suppurated tumour, is really a slough, concealing an ulcer of the same dimensions. All the parts of the fauces above-mentioned are liable to these ulcerations. . . . The disease seems to have no stated period which can properly be called its acme or height. Some grow easier from the first day of the attack ; but in general, the systems of recovery appear on the third, fourth, or fifth day, and proceed in the following manner : First, the redness of the skin disappears ; the heat grows less ; the pulse, which was hitherto very quick, becomes slower ; the external swellings of the neck subside ; the sloughs in the fauces cast off ; the ulcerations fill up ; the patient sleeps without confusion."

Treatment was a difficulty, for Fothergill found that bleeding, purging, gentle cathartics and "nitrous cooling medicines" were all of no avail, and he advises against them, and he had to fall back

upon small draughts of mint-tea together with "some grateful and warm aromatic, cordial medicine" every four or six hours. He also advised against attempting to remove the sloughs in the throat.

An account of what apparently was true diphtheria was written in 1757 by John Huxham (1692-1768), who had studied at Leyden under Boerhaave and who practised at Plymouth, and he was the first to notice that diphtheria was sometimes followed by paralysis of the soft palate. A third classic description, clearly referring to diphtheria under the name of "croup", was published in 1765 by Francis Home of Edinburgh (1719-1813). His book is entitled "Inquiry into the Nature, Causes and Cure of the Croup", in which twelve instances of the disease are given, and the peculiar crowing voice, from which the name "croup" was formed, is prominently mentioned. Several necropsies were obtained; in the first, Home states: "To my great surprise the whole superior internal surface of the trachea was covered with a soft, thick preternatural coat or membrane, easily separable from it and generally lying loose upon it, and purulent matter—lodged below and round it. . . . This condition was continued into the ramifications of the bronchial Tubes. The subjacent parts were red, but there was no great degree of inflammation." Home recommended that tracheotomy should be tried in "croup", so that the removal of the false membrane might be attempted through the artificial opening.

There was little, if any, advance in methods of operating upon the tonsils. Richard Wiseman (1622-76), surgeon to King Charles II, describes, in his "Chirurgical Treatises", the methods he employed and relates the histories of some of his cases. After drawing the tonsil out as far as possible, he placed a ligature around its base, and then excised it with scissors. Wiseman also frequently used escharotics and the actual cautery when he had reason to fear haemorrhage or when the tonsil was very adherent. The French surgeon Pierre Joseph Desault (1745-95) seems to have been the first to use a special instrument for the removal of the tonsils. It was a modification of an instrument known as the cystotome or "Kiotome", which was used for dividing cysts of the bladder. It consisted of a metallic sheath cut into the shape of a half-moon at one end and with two rings at the proximal extremity by which it could be held. A knife blade was arranged so as to pass through the sheath across the

half-moon notch after the latter had been adjusted to the tonsil, which was drawn into it by means of a hook. But Desault's instrument was not generally adopted and eventually lapsed into desuetude.

TRACHEOTOMY

As regards tracheotomy, the operations performed by Habicot have already been mentioned, and he was the first to perform tracheotomy in order to remove a foreign body (blood-clot from wounds by a knife) from the larynx. In 1707 Pierre Dionis wrote that it was wrong to call the operation "laryngotomy" : "bronchotomy" was the proper word. Lorenz Heister, in his "Chirurgie" (1718), gives it as his opinion that the operation should be called "tracheotomy" and that the other names should be discarded, but tracheotomy did not displace the other terms until the beginning of the nineteenth century ; Heister records a case in which by tracheotomy he was able to extract a piece of boiled mushroom from the trachea of a man who had laughed when eating mushroom broth. It was Desault who clearly distinguished between laryngotomy and tracheotomy. The former, he states, is performed by cutting transversely through the crico-thyroid membrane or vertically through the cricoid cartilage ; the latter by cutting transversely between the rings of the trachea or vertically through the rings.

Up to the nineteenth century tracheotomy was contemplated only as a last resort in acute illnesses or accidents and to relieve rapidly impending suffocation ; de Garengeot, in 1720, suggested that the operation was always delayed until too late, although he does not himself appear to have attempted it at all. The first to perform tracheotomy in Britain was George Martine (1702-43) of St. Andrews, in 1730, before he was 30 years old. Martine is also notable as having been the first to advise the use of a double tracheotomy tube, an inner tube having the advantage of being easily removable and cleaned, and so keeping the tube clear of mucus without having to remove the tracheotomy tube altogether ; in Martine's description of the operation he ascribes the original suggestion to one of the ministers of St. Andrews. "In a few hours", he writes, "the poor lad would have strangled to death most miserably. Whence you see it was not out of an itching desire of making experiments or a wanton officiousness, that we directly set about the operation." Martine was educated at

Leyden and the University of his native town, where he practised for some years ; but he went as fleet surgeon in the ill-fated expedition to Cartagena and there he died of malaria.

A curious episode in the history of tracheotomy, which is worth recording, occurred in 1733, when a London surgeon named Chovell persuaded a condemned man, a highwayman named Gordon, to allow him, for a substantial fee, to perform tracheotomy on him the night before the execution. The surgeon had tried the experiment previously on several dogs and always with success, but his human subject, although still alive when cut down by his friends after the hanging, succumbed very soon.

CHAPTER V

OTOLOGY BECOMES A SCIENCE

At the beginning of the nineteenth century the knowledge of the anatomy of the ear was almost complete, and only the finer details awaited investigation. Among the histologists of the time was the Italian, Marquis Alfonso Corti (1822-88). Of his life we know little, but his name is perpetuated in the organ of Corti within the cochlea, which he was the first to describe in detail. The physiology of hearing remained obscure and was elucidated only very slowly, and it was not until the middle of the century that the eminent physicist, Hermann von Helmholtz, published his notable contribution to acoustics entitled "Sensations of Tone" (1862), thus providing a solution to many an obscure problem. Helmholtz's theory of hearing, the piano theory, as it was called, from the semblance of the cochlear fibres to the strings of a piano, at once gained acceptance and proved of the greatest value in otology.

RESEARCHES ON THE LABYRINTH

In the meantime it was shown that the other part of the labyrinth, the semicircular canal system, was concerned in the function of equilibration. Charles Darwin's grandfather Erasmus Darwin, in his classic work entitled "Zootomia", published in 1801, gave an account of the phenomenon of giddiness associated with turning movements, but he did not realize that the sense of equilibration was intimately related to the inner ear or labyrinth. M. J. P. Flourens, of Paris (1794-1867), found that section of those canals in pigeons produced peculiar movements of the head, varying according to the canal injured; Flourens was the first to suggest that the acoustic nerve consisted of two parts, a cochlear part concerned in hearing, and a vestibular part concerned in equilibrium. J. Breuer, of Vienna, published in 1874 the results of experiments in which he had subjected animals to rotation, and had noted that they exhibited movements of the head similar to the movements observed by Flourens in pigeons. He also noticed that animals developed head nystagmus, while man showed ocular nystagmus, and he identified these two phenomena with one another. Thus, as Borries recently indicated, Breuer ought to be

accounted the discoverer of vestibular nystagmus, since he was the first to point out that that long-known movement of the eyes was a labyrinthine reflex. Breuer paved the way for the later work of Ewald in 1892, and for the still later clinical researches of Bárány, begun in 1905. Crum Brown, the erudite Professor of Chemistry at Edinburgh, suggested in 1874 that the canals were associated with the sense of position, but it was not until much later that Bárány (in 1907) worked out a series of tests for semicircular canal function, and made a valuable contribution to the diagnosis of labyrinthitis. Further attention was focused on the labyrinth by the description of Prosper Ménière (1799–1862) of the disease or “symptom-complex” which bears his name. That Ménière’s disease is due to haemorrhage into the labyrinth is a tenet based on a misinterpretation of Ménière’s description of the necropsy in a single case which he published in his original paper and which has led to much confusion of thought. The importance of Ménière’s original observation was that until then vertigo had been looked upon as denoting an intracranial disorder, and he showed that it could be due to an affection of the internal ear.

Ménière published his case in the “Gazette médicale de Paris” on September 21st, 1861, p. 598, and begins : “I have spoken elsewhere, a long time ago, of a girl who journeying on the box-seat of a stage coach, became as a result of *the* severe cold [not *a*] suddenly and completely deaf”. He goes on to describe her principal symptom as continuous vertigo, the least effort at movement causing vomiting, and she died on the fifth day. Post-mortem examination showed the brain, cerebellum and spinal cord absolutely free from any change and the only lesion “a red, plastic matter, a sort of bloody exudate” in the semicircular canals and nowhere else in the labyrinth. The “elsewhere” in the first sentence is important. Miles Atkinson recently, and Dan McKenzie some years ago, hunted this down and found it in a translation by Ménière of Kramer’s treatise on diseases of the ear, published in Paris in 1848, where on p. 397 Ménière again speaks of the girl and the necropsy, but does not mention the vertigo or the vomiting, and says that he found “a plastic, reddish lymph” throughout the labyrinth, not in the semicircular canals alone. Did Ménière unconsciously embroider fact to conform to theory, thirteen years later ? Or did he through carelessness (for he had not the typical French precision) omit the description of vertigo in his first account ? One cannot tell now ; but in neither

account is there blood in the labyrinth. Haemorrhage into the labyrinth does, however, occur, though it is somewhat of a rarity, in leukaemia, as Gustav Alexander of Vienna was the first to point out.

FRENCH AND GERMAN PIONEER OTOLOGISTS

France was the first country to remove otology from the sphere of the surgeon and to give it a place of its own. One of the first to specialize in this branch was Jean Marie Gaspard Itard (1774–1838). Itard was a military surgeon of Paris who made a special study of the ear, and whose excellent textbook “*Traité des maladies de l'oreille et de l'audition*” (1821) did much to place otology upon a sound scientific basis. Itard deserves to be remembered also for his painstaking researches on deaf-mutism, and on the education and rehabilitation of the deaf. He was a worthy follower of the Abbé de l'Epée, to whose devotion to the interests of the deaf, during the eighteenth century, reference has been made elsewhere (page 75). Itard's book, the result of twenty years of observation and experience, provides a clear and critical survey of all the known facts. He exposed some of the errors of his predecessors, in particular the opening of the mastoid antrum as a cure for deafness, although he went too far in stating that even in cases of mastoiditis this operation was not to be recommended. Itard practised lavage of the Eustachian tube through the catheter, and, later, he recognized that inflation with air was to be preferred. He appears to have been one of the first to advise inflation as a routine mode of treatment in certain cases of deafness.

Another French pioneer was Antoine Saissy (1756–1822) who, like Itard, was a surgeon in Paris. Saissy was strongly opposed to Astley Cooper's operation of puncture of the tympanic membrane, which he regarded as dangerous. He treated chronic middle-ear suppuration by lavage through a Eustachian catheter, and he was probably the first to use a Eustachian bougie. A third French otologist of the period was Nicolas Deleau (the younger) (1797–1862). He improved the technique of the Eustachian catheter and was an early exponent of its use as a means of inflation of the tympanum with air, the so-called “air douche”. Stimulated by the example of Laennec, who had just introduced auscultation as a means of diagnosis of diseases of the chest, Deleau employed an “auscultation tube” in order to convey to the observer the sound produced by inflation through the catheter.

Of slightly later date was the German pioneer otologist

Wilhelm Kramer of Berlin (1801-75). In 1835 he published a notable work, "Die Erkenntnis und Heilung der Ohrenkrankheiten". Commencing with a critical review of what he calls Acoustic Medicine, he severely criticizes the misdirected enthusiasm of his French and English predecessors, especially Curtis (whose work we shall presently study), "from whom, as the head of a large institution for the treatment of diseases of the ear, verily better performances might have been expected". Kramer continues, "Buchanan is the only English practitioner who understands and practises catheterism of the Eustachian tube", and having also disposed of the "worthless work" of Saissy and the "great imperfections" of Itard, he proceeds to give his own account of the subject. Electricity and galvanism, in his view, were "utterly useless in diseases of the ear". Kramer describes in great detail the method of using the Eustachian catheter, which he connected to a compressed air apparatus or "air press". If the forcible jet of air did not enter the tympanum, he employed a catgut bougie which was left in position for several hours, after the withdrawal of the catheter, and was to be removed by the patient himself. The cases which are not relieved by the catheter are classed by him as "nervous deafness". Kramer's work owes much of its value to his careful records of sixty-five illustrative cases. He appears to regard suppurative otitis media, both acute and chronic, as "inflammation of the membrana tympani". The chief remedies are the application of leeches and the use of ear drops of a solution of acetate of lead. Mastoiditis is not even mentioned.

Although Ingrassia in 1546 was the first to note that a vibrating tuning-fork could be heard when pressed against the teeth, the first tuning-fork test of the hearing was that of E. H. Weber, of Leipzig, whose early studies, in collaboration with his physicist brother Wilhelm, were published in 1825, though his exact description of the test known by his name was not published until 1834. Adolf Rinne of Göttingen described (among a score of others) the test known by his name in 1855, but its use in clinical diagnosis was not generally recognized until Lucae and Bezold emphasized its value a generation later. D. Schwabach of Berlin published criticisms of Weber's and Rinne's tests and put forward his own in 1885. In spite of many objections, the Weber, Rinne and Schwabach tests have proved themselves up to the present the most valuable methods for differential diagnosis between conductive and perceptive deafness.



FIG. 22
Jean Marie Gaspard Itard, Pioneer French
Otologist (1775–1838)



FIG. 23
William Kramer, Pioneer German
Otologist (1801–75)



FIG. 24
Hans Wilhelm Meyer, of Copenhagen
(1825–95)



FIG. 25
James Hinton, of London
(1822–75)

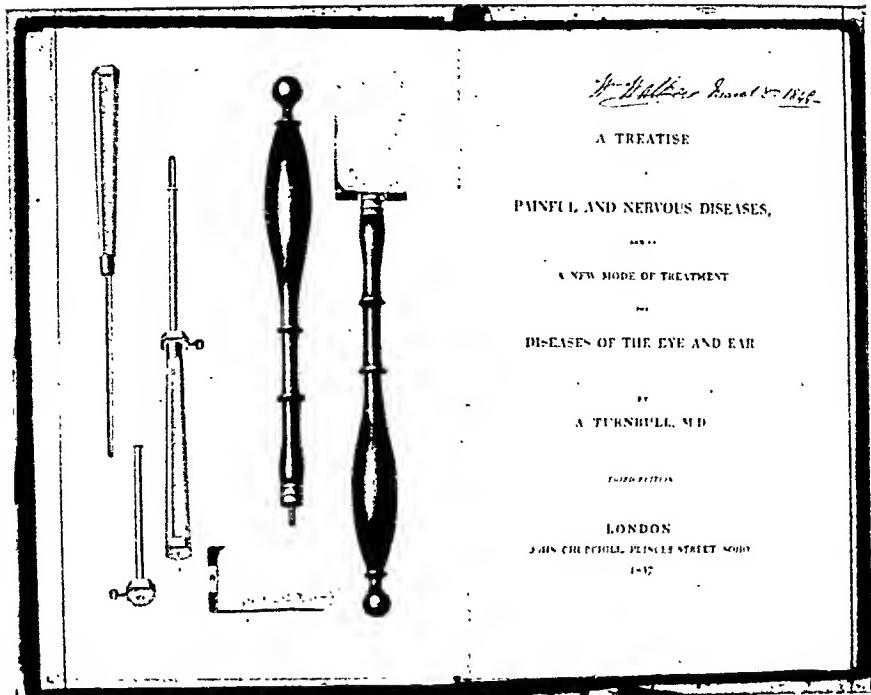


FIG. 26
 The Auresector and the Friction Sponge
 (From A. Turnbull's "Treatise", 1837)



FIG. 27
 French and Spanish Artificial Ears, and Hearing Trumpet
 (From "Physiology and Diseases of the Ear", by John Harrison Curtis, 1817)

ENGLISH SURGEONS AND OTOTOLOGY

Meanwhile in England, the practice of otology was undertaken partly by surgeons as a sort of side-line to their other work and partly by unqualified practitioners. As examples of the former class, the names of Astley Cooper and Saunders have been already mentioned. Another early exponent of otology, who practised in Hull, was Thomas Buchanan, whose treatise, entitled "Physiological Illustrations of the Organ of Hearing", was published in 1828 and is still worth reading. Buchanan was much concerned with the outer ear, and he described in great detail his measurements of the pinna, the external auditory meatus, and the tympanic membrane in man and animals, making a noteworthy contribution to the science of acoustics. He stressed the importance of cerumen as an aid to hearing, and he prescribed an ointment when the wax "was insufficient in amount to lubricate the tympanic membrane". He was ahead of his time in stressing the importance of "the will to hear", the tension caused by expectation, as is noticed in animals when they "prick up their ears". He noted the effect of distance upon harmony, and of the baneful effect of loud sounds, stating that "the Highland bagpipe, which at a little distance on a wide and blooming heath has a melody and sweetness particularly agreeable to the Scottish ear, may produce a stunning effect when played in a small apartment". Although Buchanan was more interested in acoustics than in pathology or therapeutics he was, nevertheless, one of the first to recommend the use of artificial light instead of sunlight, as a means of inspecting the tympanic membrane. His complicated lamp, with a candle as the illuminant, was called the Inspector Auris. As one of Buchanan's reviewers wrote, "Hull was the very spot to give birth to such a substitute for solar light". In David Tod's book, "The Anatomy and Physiology of the Organ of Hearing", published in London in 1832, a chapter is devoted to congenital deafness and its treatment, and two shorter chapters to diseases of the ear and to disorders of speech. He described nine muscles (besides ligaments) of the middle ear, but felt that the functions of the labyrinth "will, I fear, for ever remain among the arcana of Nature". He followed Sir Astley Cooper in puncturing the drum-head, but did not find it beneficial for tinnitus or deafness. He approved of perforating the mastoid process when carious, but does not appear to have done it himself.

Of greater importance from the clinical standpoint was the treatise by George Pilcher of London on "The Structure, Economy and Diseases of the Ear", which won for him in 1838 the Fothergillian Gold Medal of the Medical Society of London. Pilcher, who was a general surgeon to St. George's Hospital, was a well-trained anatomist, and he devoted more than half of his "essay" to the anatomy, and especially the comparative anatomy, of the ear. He deals very fully with the structure of the ossicles in various birds and mammals, and he gives one of the earliest accounts of the otoliths in fishes. His classification of ear diseases as otitis, chronic diseases and nervous diseases is not very clear. He advises immediate incision of a mastoid abscess, but although he recognizes the danger of intracranial complications, he remarks that the subject is "still involved in a good deal of mystery". For catarrhal otitis he employed inflation, using a curiously curved catheter of his own design. The surgical principles applied by Pilcher and other surgeons to otology ensured progress on scientific lines.

THE EAR AS A FIELD FOR QUACKERY

Very different were certain other practitioners of otology who contested the field at about this time. A sample of their work may be noted in "A Treatise on Painful and Nervous Diseases of the Ear", by A. Turnbull, which appeared in 1837. Turnbull ignores anatomy and does not discuss diagnosis, contenting himself with vaunting two methods of treatment: the application to the mastoid region of an ointment, by means of a special "friction sponge", and the puncture of the tympanic membrane by a tiny trephine or "auresector".

But the most notorious effort to make capital out of the precarious position of the embryo science of otology was made by John Harrison Curtis. It must be remembered that at that day there was no Medical Register, so that the public and the medical profession were not protected against unqualified practice. Curtis had been a dispenser in the Navy and possessed no medical qualification, but he was a man of forceful personality who had married a lady of means and position. Establishing himself in a handsome house in Soho Square, then a fashionable quarter of London, he soon acquired a large and aristocratic practice. In order to advertise and further his claims as an aurist, he founded an Ear Dispensary in 1816 for which he managed to secure Royal

patronage, and which, having been purchased from the executors of Curtis "as a going concern" by William Harvey, eventually became the Royal Ear Hospital in 1845. In his "Autobiographical Recollections of the Medical Profession" (1874), an interesting if somewhat outspoken commentary, G. F. Clarke relates that Curtis was "profoundly ignorant even of the anatomy of the ear", and that it was his custom to treat almost every case by syringing the ear with an enormous instrument like a garden syringe. He even ordered Sir Robert Peel, then Home Secretary, "If you don't hold your tongue, I shall certainly do you a mischief", as was true. Curtis's book on "The Physiology and Diseases of the Ear" is full of inaccuracies. He states that he has "with much pains collected a variety of contrivances to assist hearing. Spanish ears, made of shell, answer the purpose very well, while in some patients the German silver ears are better than any." The frontispiece of the book illustrates those hearing aids. Curtis had a meteoric career; for a time he made £5000 a year before he squandered his fortune, fell into debt, fled the country and eventually died in poverty. It is not surprising that when Curtis, then at the height of his fame, read a paper at the Medical Society of London in 1837, Joseph Toynbee, who was present, afterwards wrote to the "Lancet" on the fallacies of Curtis's pathology, and registered a vow that he would "rescue aural surgery from the hands of quacks".

YEARSLEY THE PIONEER

Toynbee was not alone in this resolve, nor was he first in the field. Two other pioneers are worthy of mention—James Yearsley of London and William Wilde of Dublin. James Yearsley was born at Cheltenham in 1805 and became apprenticed to Ralph Fletcher, a surgeon at Gloucester, whose daughter he married. He became a pupil at St. Bartholomew's Hospital and took the diploma of M.R.C.S. in 1827 (long before the F.R.C.S. was instituted), and later graduated M.D. at St. Andrews. After practising for a short time at Cheltenham and Ross-on-Wye he studied abroad, chiefly in Paris, then coming to London to practise as an aural surgeon soon achieved success. In 1838 he founded the Metropolitan Ear Institution in Sackville Street, Piccadilly, which developed into the Metropolitan Ear, Nose and Throat Hospital, the first hospital of its kind in the world. For Yearsley was the first to practise as an ear, nose and throat

specialist, not as a surgeon-aurist or as aurist and oculist, and he repeatedly pointed out in his writings the influence on the ear of affections of the nose and throat; he was at the same time author of a textbook on diseases of the ear and of other works on the art of laryngoscopy and on throat ailments.

"Almost all diseases of the ear", Yearsley wrote, "originate in a morbid condition of the mucous membrane of the throat, nose and ear, which becomes affected from a variety of causes, among which cold, the exanthemata, especially scarlatina, and stomach derangement stand pre-eminent." He advised tonsillectomy in many cases, dissecting out the tonsil with a curved bistoury after seizing it with a tenaculum; in the third edition of his book (1850) he mentioned that he had operated thus upon 1400 patients. Furthermore, he made the important observation that he "suspected an overlapping of the mouths of the Eustachian tubes by loose mucous membrane", and he noted that "shortly after excision of a small slip of mucous membrane from underneath the arches of the palate, amendment more or less considerable [in hearing] has taken place". Thus Yearsley came very near to the discovery of adenoids, which was made by Wilhelm Meyer of Copenhagen some years later. Another noteworthy advance made by Yearsley was the introduction of the "artificial ear drum", a small pellet of moistened cotton-wool which assisted the conduction of sound in dry perforations of the tympanic membrane—a method still employed in suitable cases. He was an enthusiastic advocate of the value of Eustachian catheterization in the diagnosis and treatment of deafness, in opposition to Toynbee, who discarded catheterism and used the auscultation tube only, believing that during the simple act of swallowing the air in the tympanum was condensed, and listening with the tube would give him the necessary information.

James Yearsley is to be remembered for his efforts to raise the standard of medical practice. In 1846, along with Tyler Smith and Forbes Winslow, he founded the "Medical Directory", of which he became sole proprietor on the retirement of his two partners; this recording of the names of all recognized practitioners was an important step towards the Medical Registration Act of 1858. Yearsley was also the originator and proprietor (though not the editor) of the "Medical Circular" (1852), a journal which in 1866 was incorporated with the "Dublin Medical Press" (founded 1839); this periodical still enjoys an active life.



FIG. 28
James Yearsley (1805-69)

(From the portrait in the Metropolitan Ear, Nose and Throat Hospital)



FIG. 29
Joseph Toynbee (1815-66)
(From the portrait in the Toynbee Room, Royal Society of Medicine)

as "The Medical Press". Unfortunately his impatience and intolerance did not add to Yearsley's popularity ; nevertheless he was a worthy pioneer of oto-laryngology. Yearsley died in 1869 at the age of 64, and was buried at Sutton Bonnington, Notts, where his eldest son was rector. For many years he had conducted a large practice in London, and he had as his assistant Peter Allen, who later succeeded Toynbee at St. Mary's Hospital, and whose book, entitled "On Aural Catarrh and Curable Deafness" (1871), gave a clear account of the otology of the time, with special reference to the employment of the chief instrument, the Eustachian catheter.

THE ACHIEVEMENT OF JOSEPH TOYNBEE

Of slightly later date was Joseph Toynbee, who may well share with Yearsley the title of the "Father of British Otology". But while Yearsley was eminent for his clinical acumen and ability, Toynbee sought to build otology upon a sure foundation of pathology. Thus, each contributed from his own angle. Unfortunately the two pioneers did not collaborate ; indeed, they waged a wordy warfare for years, chiefly regarding the artificial ear-drum, regarding which each vehemently claimed priority.

Joseph Toynbee was born at Heckington in Lincolnshire in 1815, and was thus ten years younger than James Yearsley. As a student, he showed that special aptitude for anatomy which he developed and turned to such good account in later years. He became Assistant Curator to the Royal College of Surgeons, under Professor Richard Owen, and in 1842, while still in his twenties, he was admitted a Fellow of the Royal Society for his researches "On the Non-vascularity of Articular Cartilage, the Cornea, Crystalline Lens and Vitreous Humour, and of the Epidermoid Appendages"—to quote the full title of his paper which was published in "Philosophical Transactions" in 1841. His name appears in the first list of Fellows of the Royal College of Surgeons of England.

Although this able young man was warned that he would make nothing of aural surgery, he nevertheless determined to enter the unpromising field. "I will work at it for ten years," he replied, "and if nothing can be made of it, I will tell you why." Thus he settled down to fulfil his mission, and within a few years he had dissected more than 2000 temporal bones and had formed

the collection which became known as the Toynbee Collection, in the Museum of the Royal College of Surgeons. The significance of this work may be appreciated from a study of Toynbee's "Diseases of the Ear", published in 1860, which may well rank as a medical classic. Prior to the year 1800, thousands of dissections of nearly all the organs of the body had been made, but scarcely a single dissection of a diseased ear had been recorded. Toynbee set out to remedy this lack of appreciation of the importance of aural pathology. His book contains numerous statistical tables and accounts of the relationship between morbid appearances found in the temporal bone after death and the symptoms which, in many cases, had been noted during life. For example, Toynbee showed that stricture of the Eustachian tube, far from being a common affection, was demonstrable in only one of his 1523 dissections. He also noted that the Eustachian tube was not permanently open, but lightly closed, and that it became opened only during such movements as swallowing or yawning. Ten cases of osseous tumour (osteoma) are described and illustrated, as well as a number of cases of "molluscous" tumour, which we should now recognize as cholesteatoma.

In one of his dissections Toynbee recognized a fistula of the external semicircular canal, and he pointed out that infection could extend to the brain by way of the labyrinth. Although he was more of a pathological anatomist than a clinician, Toynbee was a keen and careful observer, a strenuous worker, and an original thinker ahead of his time. In 1857 he was appointed Aural Surgeon to St. Mary's Hospital, the first general hospital to set aside beds for diseases of the ear, and to institute the teaching of this subject. To the Governors of that hospital he dedicated the treatise to which reference has been made. He conducted a successful practice at Savile Row, and he resided at Wimbledon, then a country village. Toynbee was endowed with an attractive and charming personality. Much of his time was devoted to philanthropic work ; he founded a Samaritan Fund to assist the sick poor of Wimbledon, and he also endowed a village club and a museum there. Ventilation was one of his hobbies, and it was said that if his patients were not benefited in hearing, at least they left his consulting-room with detailed information regarding the value of fresh air.

In examining the ear, Toynbee used a speculum which he designed, but not a reflector ; the concave aural mirror was intro-

duced in 1855 by Anton von Tröltsch of Würzburg. Aural polypus was classified by Toynbee as an affection of the external meatus, and was treated by the application of caustic potash. For otitis media he advised "leeches behind the ear" and "copious syringing with warm water". His commentary on mastoiditis is interesting. Toynbee writes: "Perforation of the mastoid process suggests itself in serious cases likely to terminate in death. I have never performed the operation but should not scruple to do so where the life of the patient was threatened."

Toynbee describes in his book a number of affections of the tympanic membrane which we should now recognize as indications of diseases within the tympanum. He was enthusiastic regarding his "artificial drumhead", a disc of gutta-percha mounted on a silver wire. One patient treated by this contrivance "was obliged to move to a quiet street, as the noise of the traffic became oppressive when the artificial membrane was applied". Toynbee was one of the first to describe otosclerosis, recognizing "ankylosis of the stapes to the fenestra ovalis" in 160 cases. He related how one patient was temporarily relieved by a loud noise. A deaf clergyman, in his Sunday school "was called upon to chastise a boy who was endeavouring to bite his teacher" when the boy, in the words of the patient, "sent such a yell into my right ear that I heard not only the yell, but for some days other sounds most distinctly". Toynbee explains that "the effect of the scream was to release the stapes for a time". In the concluding chapter of his treatise, Toynbee deals with "Nervous deafness", and among the causes he notes over-study, want of sleep, gout and typhus fever.

Joseph Toynbee died at the age of 51, on July 7th, 1866, as the result of an experiment on himself. Believing that tinnitus might be relieved by inhalation of the vapours of chloroform and prussic acid, with subsequent Valsalva inflation, he subjected himself to the test, with a fatal result. He thus became a martyr in the cause of the science of otology. His son, Arnold Toynbee, was a brilliant student who devoted his short life to social work and who died at the age of 26 years. Two years after his death the first University Settlement was founded in Whitechapel by Canon Barnett, and was named "Toynbee Hall".

PHILOSOPHY AND OTOLOGY

James Hinton, the assistant and successor of Toynbee, was another worthy pioneer of British otology. Hinton, who was the

first Aural Surgeon to Guy's Hospital, must not be confused, as he sometimes is, with John Hilton, the author of "Rest and Pain". Hinton's book, "The Mystery of Pain", is a philosophical work which at one time was widely read. Although he did good work as an otologist, James Hinton will be remembered chiefly as a philosopher. Besides "The Mystery of Pain", he wrote "Life in Nature" and "Man and His Dwelling Place". To quote from the obituary notice in the "Lancet" (Jan. 1876) by Sir Samuel Wilks, himself no mean philosopher : "Hinton was one of the most remarkable men in our profession, but being in it he was not of it. The speculative and metaphysical occupied his mind, and his doctrines were all visionary. Nevertheless he did make a useful contribution to otology, and all his books, whether otological or philosophical, are written in a clear and delightful style."

Hinton was born in 1822, the son of Rev. James Howard Hinton, who was the most intellectual and eloquent dissenting preacher in London, a man who "could speak, without a note, on a wide range of topics". The boy's mental progress was marked by a curious episode. He had been gifted with a singularly retentive memory, and would know a lesson by heart after reading it over once. But one day, rushing in from a game of cricket to do his lessons at the last moment, as was his wont, he realized that his remarkable memory had suddenly left him. It remained good throughout his life, but the abnormal retentiveness had gone. After leaving school he was employed for a time as a city clerk, and at this period he immersed himself in the study of history, languages and all manner of subjects, to such an extent that his health suffered. The family doctor, who was consulted, wisely advised that this studious youth should enter the profession of medicine. He soon became qualified, and after several voyages as a ship's surgeon he commenced practice in London. His association with Toynbee was that of a close and life-long friend. Hinton edited the second edition of Toynbee's "Diseases of the Ear", and succeeded Toynbee in practice in his house at 18 Savile Row, where Hinton, in turn, was followed by Sir William Dalby and later by Arthur Cheatle.

Hinton was never really happy in his medical work. "Can Science reveal to us the reality of the world?" he asks, and replies: "Science can only explain a Beethoven violin quartette as the scraping of the tails of horses on the intestines of cats". On his

appointment as Aural Surgeon to Guy's Hospital in 1863, Hinton foresaw that philosophy and otology could not well be wedded, and for some years he devoted all his attention to otology. He was not content merely to be a satellite of Toynbee, and in his supplement to Toynbee's book he made a number of original observations. He noted that aural polypus was not a disease of the external meatus but "might grow through a perforation in the membrana tympani". He showed how "molluscous tumours" (cholesteatoma) might cause death by eroding the bone and causing infection to spread to the brain. He urged "early puncture of the membrane in acute suppuration within the tympanum", and he observed that "an important sign of disease of the mastoid process is a red swelling of the posterior wall, which might be confounded with a boil if the symptoms did not indicate a more serious affection". He advised more careful attention to ear disease in childhood, and laid stress on the importance of examination of the ear with which every general practitioner should be familiar.

It was characteristic of Hinton that his own volume on otology was neither a manual nor a treatise, but an oracle, entitled "The Questions of Aural Surgery". In the preface he states that "the whole stress of the book is laid on the points which want clearing up". It is not generally known that Hinton was the first in Britain to perform the mastoid operation by opening the antrum and cells. The patient was a man aged 58, and in describing the operation Hinton advised that "if the division of the periosteum over the mastoid process leaves the symptoms unchecked, the perforation of the mastoid cells should not be delayed: A gouge or drill may be used. I employ a drill with a movable guard so that the bone may be penetrated to any desired extent." At the age of 52, Hinton gave up practice and went to take charge of a property which he had acquired in the Azores, and he died there a few weeks after his arrival.

THE AURAL SURGERY OF SIR WILLIAM WILDE

Another pioneer, who must be linked with Yearsley, Toynbee and Hinton, was Sir William Wilde of Dublin, the father of Oscar Wilde. The son of Dr. Thomas Wilde, a well-known medical practitioner, William Wilde was born at Castlereagh in 1815, the year of Toynbee's birth. After graduating in medicine at Dublin,

he spent some months in voyaging in a yacht in charge of a distinguished invalid, and the outcome of those travels was his "Narrative of a Voyage to Madeira, Teneriffe and the Shores of the Mediterranean". Published in 1840, this work won for its writer a high reputation, enhanced by his later books on "The Beauties of the Boyne and Blackwater" (1849) and "Lough Corrib and Lough Mask" (1867), which deal with the history and antiquities of those parts of Ireland. Those researches won for him the Gold Medal of the Royal Irish Academy. He also published an interesting little account of "The Closing Years of the Life of Dean Swift" (1840), with the object of refuting the statement that Swift was insane in his later years.

In 1851, Wilde married Jane Francisca Elgee, a lady of energy and ability who was well known for her literary work, written under the pseudonym of "Speranza". She appealed to the young men of Ireland to take up arms against the Crown, and was unsuccessfully prosecuted for sedition. Nevertheless, Lady Wilde was awarded a Civil List pension after the death of her husband, in recognition of her services to literature. Besides a volume of Poems (1871), she published "Driftwood from Scandinavia" (1884), but perhaps her best-known work was "Ancient Legends, Charms and Superstitions of Ireland" (1887).

William Wilde studied in London, Berlin and Vienna, then settled in Dublin as an "oculist and aurist", and soon acquired a large practice. His first earnings were applied in renting a disused stable which he converted into a dispensary, and thus, in 1841, arose St. Mark's Hospital for the Eye and Ear. In this institution, Wilde was the first to teach otology in the United Kingdom. During the same year he was selected as Medical Commissioner for the Irish Census, and for his services to statistical science in that capacity he received the honour of knighthood. Following his census investigation, Sir William Wilde wrote a history of "The Epidemics of Ireland", and in 1839 he assisted in founding the "Dublin Medical Press" which, it is interesting to note, became amalgamated in 1866 with the "Medical Circular" founded by James Yearsley in 1852. In the meanwhile his specialist practice was by no means neglected. His volume on "Aural Surgery", published in 1853, was the fruit of long and patient observation. Like Toynbee, Wilde applied to otology the lessons of morbid anatomy and of general medicine; like Toynbee, he "laboured to divest this branch of medicine [otology] of that



FIG. 30
Sir William R. Wilde (1815-76)
(From "Dublin University Magazine, 1875")

CHIRONOMIA:

Or,
The Art of
Manuall Rhetorique!

WITH THE
Canons, **L**awes, **R**ites, **O**rdi-
nances, and **I**nstitutes of **R**HETO-
RICIANs, both **A**ncient and
Moderne, Touching the **a**rtificial
managing of the **H AND D**.
in Speaking.

Whereby the **Naturall GESTURE** of the
H AND D, are made the **Regulated Ac-**
cessories or **faire-spoken Adjuncts** of
RHETORICAL Utterances.

With **X Y P E S**, or **C H I R O G R A M S**:
A new illustration of this Argument.

By **J. B. Philochinophilus.**

Ratio et Criterium Intellectus, Rationis Oratio;
Orationis Manus, Scala.

LONDON:

Printed by **The Harps**, and are to be sold by
Richard Whitaker, at his shop in Pauls
Churche-yard; **1 & 4 d.**

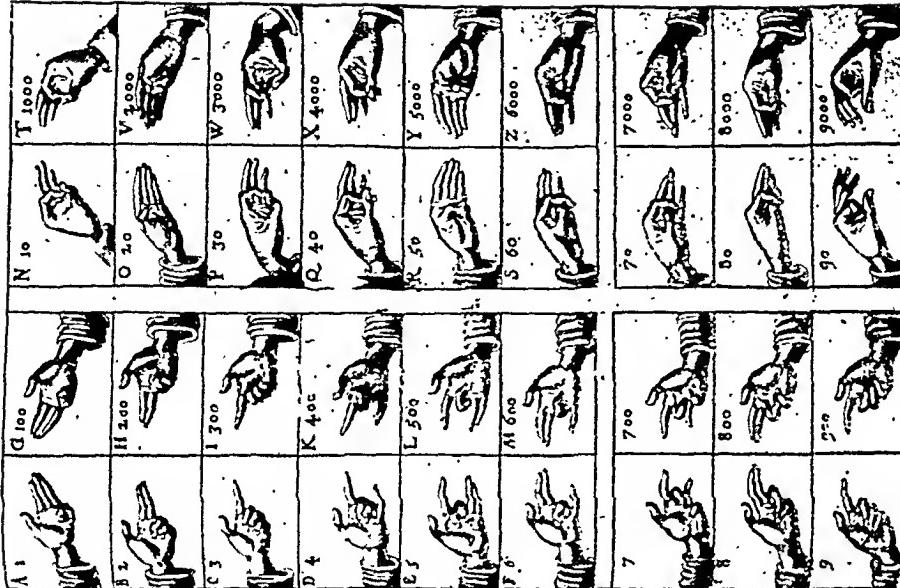


FIG. 31

Title-page of John Bulwer's "Chironomia" (1644), one of the early Works on the Education of Deaf-Mutes

FIG. 32
John Bulwer's One-handed Alphabet for the
Education of Deaf-Mutes

shroud of quackery with which it has been encompassed". "Aural Surgery" contains much sound advice. For example, Wilde stated that "so long as otorrhoea is present, we never can tell how, when and where it will end or what it may lead to". His favourite applications were liquor alumnis and liquor plumbi, but he insisted that simple cleanliness was "the chief part of the treatment". A curious piece of advice to sufferers from catarrhal otitis was the moderate use of tobacco, but he insisted that the smoke must be "inhaled from a good cigar, and puffed out through the nose". An important practical advance which he initiated was the angle in the shaft of such instruments as aural forceps or aural snares. Wilde did not practise paracentesis for acute otitis, but in cases of so-called Eustachian obstruction he made an artificial perforation of the tympanic membrane, cauterizing the edges with nitrate of silver to ensure patency.

Nevertheless, he is chiefly remembered today for his method of treating acute mastoiditis by "Wilde's incision". "Should the mastoid process become engorged," he wrote, "or even an indistinct sense of fluctuation be discovered, we should not hesitate to make a free incision at least an inch in length. The head should be firmly secured against some unyielding substance and the blade of a stout scalpel inserted steadily until the point reaches the bone, to secure complete division of the periosteum. . . . From the swollen state of the parts, we are sometimes obliged to introduce the instrument at a depth of nearly an inch. Immediate relief follows, even if pus is not discovered."

Wilde's procedure was an important step in the surgical treatment of mastoiditis, although the more complete operation on the bone became possible with the discovery of antisepsis and anaesthesia. His "Aural Surgery" is a medical classic, well worth reading today. As one reads the case records, those models of clear reporting with which Wilde supports his argument, one almost feels transported to the bedside of the patient, and one realizes that something has been lost in these hurried modern days which demand a telegraphic phraseology in case-taking. Sir William Wilde died in 1876, but his influence and that of his co-pioneers in the field of otology still lives. Otology, as those men found it, was a discredited branch of surgery and a happy hunting ground for unscrupulous charlatans. The founders of modern otology raised the status to that of a worthy specialty, and in their hands otology became a science.

CHAPTER VI

THE EDUCATION OF THE DEAF

AN interesting by-path in the history of otology is the story of the education of deaf-mutes. Except for the French surgeon, Itard (1821), it is only in comparatively recent years that otologists, as well as educationists, have begun to interest themselves in this subject, two pioneers being James Kerr Love (1858–1942) of Glasgow, in Britain, and Max A. Goldstein (1870–1942) of St. Louis, in America. Kerr Love was born at Beith, Ayrshire, and graduated at Glasgow University in 1880. He became Aural Surgeon to Glasgow Royal Infirmary and lecturer on diseases of the ear at Glasgow University, was the author of a textbook of otology, and wrote much on deaf-mutism and on the deaf child, in whose problems of education and welfare he was especially interested. Kerr Love devoted much of his life and most of his leisure to the deaf and the hard of hearing.

Goldstein was born at St. Louis, Mo., graduated at Missouri Medical School (now Washington University) and studied otology under Politzer in Vienna. He became Professor of Otology at Beaumont Medical College (afterwards absorbed into St. Louis University medical school), then, feeling the need for a centre where deaf children could begin their educational training under correct methods, with the co-operation of an otologist, he founded in 1914 the Central Institute for the Deaf, with two teachers and four pupils. It developed into the internationally known centre of today, with 300 pupils from all parts of the world, a training college for teachers, hearing-aid clinic and auditory training centre, research laboratories, and close liaison with hospital and university. Goldstein's slogan was "Help the handicapped child to help himself".

It is perhaps unfortunate that the term "deafness" is applied to a defect of hearing of any degree, ranging from a slight loss which scarcely handicaps the individual at all, to a complete absence of the sense of hearing. Total deafness is relatively rare, only about 10 per cent. of all cases, but the degree of hearing in children born deaf is usually insufficient for the perception of speech, and this also applies to children whose hearing has been

lost through ear diseases at an early age, before speech has been acquired. Such children are dumb as well as deaf, though their vocal organs are normal, the inability to speak arising solely from the fact that the deaf child does not hear speech and in consequence cannot acquire the power by the usual process of imitation. But the deaf-mute can be taught to speak, especially if instruction is begun early, before the age of three.

In ancient times the deaf-mute child was regarded as a mental defective, and it is uncertain who was the first to suggest or practise the education of deaf-mutes, though the Venerable Bede (born about A.D. 673) speaks of a dumb youth being taught by St. John of Beverley to repeat letters and syllables, and then words and sentences, but at the time this was regarded as a miracle. It was not until the sixteenth century that the physician Jerome Cardan of Padua (1501-76) laid down the principles on which the teaching of the deaf and dumb is founded : "Writing is associated with speech, and speech with thought ; but written characters and ideas may be connected together without the intervention of sounds and the instruction of the deaf and dumb, though difficult, is possible".

It was in Spain in the sixteenth century that the systematic education of the deaf and dumb was begun, for religious motives, by a Benedictine monk, Pedro Ponce de León (1520-84) of Sahagun. His writings have been lost, but his work was continued by another Benedictine monk, Juan Pablo Bonet, whose book contained a manual alphabet almost identical with that in use today on the Continent and America ; nevertheless, his method of teaching—and he had a number of pupils—was oral. One of his pupils was seen by King Charles I when, as Prince of Wales, he visited the Spanish Court at Madrid on a prospective matrimonial expedition in 1623. Bonet's monograph, entitled "Reducción de las letras, y arte para enseñar á ablar los mudos" ("The reduction of letters (to their phonetic value) and the art of teaching the deaf to speak"), was published at Madrid in 1620. It is mentioned by the versatile Sir Kenelm Digby who, in his "Treatise concerning Bodies" (1644), describes how a Spanish lord, born deaf, was taught to speak by a priest, who wrote a book on the subject. Digby notes further that "he could not govern the pitch of his voice ; what he delivered he ended in the same key as he began it", that he attentively studied the face of any one who spoke to him, and that he could interpret nothing in the dark. It is an accurate

description of the monotonous speech of the deaf, and of the practice of lip-reading.

The first in Britain to devote his attention to the subject was John Bulwer, "The Chiroosopher", as he was called. Of his life little is known, but his memory survives in a number of quaint works, now rare and highly prized by collectors. His "Chironomia, or The Art of Manuall Rhetorique" (1644) deals with gesture as the natural means of communication in man. Various gestures are illustrated, although there is no attempt to construct a finger alphabet. Four years later Bulwer published another book, entitled "Philocophus, or the Deafe and Dumbe Man's friend", showing, it is stated, "that a man born deaf and dumb may be taught to heare the sound of words with his eye, and thence learne to speake with his tongue". The writer is careful to add that the tongue is "not the chiefeſt cause of ſpeech", the jaws, palate, nose and lips all being essential for correct articulation. In addition to this "Ocular Audition", or, as it is now called, "lip-reading", Bulwer notes that the deaf may appreciate music through the medium of their teeth, by "Dentall Audition". Bulwer also forecast the establishment of a "New Academie" for the education of the deaf, a project which was not realized until a hundred years later.

Contesting the priority with Bulwer, though obviously of later date, is John Wallis, Savilian Professor of Mathematics at Oxford, who had already won a great reputation as an authority on cipher writing. Wallis not only published a treatise on speech, "De loquela", in 1652, but he also made practical use of his ideas in teaching a deaf man, Daniel Whalley, to speak, and he demonstrated the method to the Royal Society and to King Charles II. Daniel Defoe refers to Wallis in his "Life and Adventures of Mr. Duncan Campbell, a Deaf and Dumb Gentleman", which appeared in 1720 and is quite in the tradition of the more famous "Robinson Crusoe". Campbell, it was alleged, was gifted with second sight, and his services as a fortune-teller were widely sought in Edinburgh and, later, in London. Defoe illustrates in his work the finger alphabet which Wallis used in addition to writing and articulation.

Contemporary with Wallis was William Holder, a dignitary of the Church, whose wife was a sister of Sir Christopher Wren, and who wrote an interesting monograph on "Elements of Speech" in 1669. In this work Holder gives an account of the position and

movements of the vocal organs in the production of the various vowels and consonants, a description to which little could be added, even today. His method of teaching the deaf consisted in demonstrating the mechanism of articulation, assisted by finger-spelling, and he also taught lip-reading. Holder added to his reputation by teaching a deaf-mute, Alexander Popham, who, however, relapsed into silence, until he was again taught to speak by John Wallis. There was some dispute between Holder and Wallis regarding the share of each in this success.

Another contemporary was George Dalgarno, a native of Aberdeen and educated at Marischal College ; he spent most of his life as a schoolmaster at Oxford, and published, in 1680, his “ *Didascalocophus, or the Deaf and Dumb Man’s Tutor* ”. Dalgarno is said to be the first writer who devised and illustrated a complete system of finger-spelling. It was a one-handed finger alphabet : touching the tips of the thumb and fingers in turn denoted A, E, I, O and U ; touching the first joints B, C, D, F and G ; the second joints H, K, L, M and N ; and so on. Dalgarno wisely insisted that the finger alphabet should not be replaced by mere sign language, and he taught the deaf reading and writing rather than speech.

The pioneer who insisted on the importance of a purely oral method of teaching was Jan Coenraad Amman, a Swiss physician who practised in Holland, and who published his book, “ *Surdus loquens* ” (“ The talking deaf man ”), at Amsterdam in 1692. This work, written in Latin, is the foundation of the method now universally approved and practised. The following century witnessed the researches of two eminent teachers of the deaf, the Abbé de l’Epée in France and Heinicke in Germany. Both deserve to be honoured, though their methods were at variance. The Abbé Charles Michel de l’Epée (1712–89) showed unsparing devotion to the interests of the deaf, although most of his attention was centred in the use of signs, and he compiled, though he did not complete, a dictionary of signs for the use of the deaf. At his own expense he founded the first school for the deaf near Paris in 1755. After his death, the school was continued by his successor, the Abbé Sicard, and after the French Revolution it was taken over by the State (in 1791); it still exists as the National Institution of Paris. Meanwhile, in Germany, Samuel Heinicke (1727–90), pastor of Nautschütz, was engaged in developing the oral method of teaching the deaf. He believed that speech should be the sole

method of instruction and of expression, and he strongly disapproved of the method employed by the Abbé de l'Epée.

In Great Britain the first school for the deaf and dumb was established in Edinburgh in 1760 by Thomas Braidwood. Braidwood was born in Scotland in 1715 and educated at Edinburgh University; for some time he was an assistant master at the Hamilton Grammar School, and later opened a mathematical school in Edinburgh. In 1760 a deaf-mute boy named Charles Sheriff was sent to Braidwood's school to learn to write, and in a few years Braidwood had succeeded also in teaching him to speak. Sheriff became a successful miniature painter in London, Bath and the West Indies; Lord Monboddo said of him in 1773 that he both spoke and wrote good English. After his success with Sheriff, Braidwood resolved to devote himself to the teaching of deaf-mutes. His method was kept secret, but was apparently a combination of lip-reading and signs; he also employed a small silver rod, "about the size of a tobacco pipe", flattened at one end and with a bulb at the other, to place the tongue in the right position. It was in 1773 that Braidwood's school, which had then "about twelve pupils", was visited by Dr. Samuel Johnson and James Boswell. Dr. Johnson characteristically wrote in his "Journey to the Western Islands of Scotland": "The improvement of Mr. Braidwood's pupils is wonderful. They not only speak, write and understand what is written, but if he that speaks looks towards them and modifies his organs by distinct and full utterance, they know so well what is spoken, that it is an expression scarcely figurative to say that they hear with the eye. . . . It was pleasing to see one of the most desperate of human calamities capable of so much help; whatever enlarges hope, will exalt courage; after having seen the deaf taught arithmetic, who would be afraid to cultivate the Hebrides?"

In 1779 Arnot (in his "History of Edinburgh") said that Braidwood's pupils were "mostly from England, but some also from America", and Francis Green in 1783 (in his "Vox Oculis Subjecta") said that Braidwood had then about twenty pupils. Braidwood moved his school to London in 1783, King George III having promised him £100 a year from his privy purse to help to make it a public institution, and he established the school at Grove House, Mare Street, Hackney, where he died in 1806, aged 90; the school was continued after his death by his daughter and two grandsons. The London Asylum for the Deaf and Dumb

was established in the Old Kent Road in 1792, its first principal being Dr. Joseph Watson, a nephew and former assistant of Thomas Braidwood; it still exists, and has developed into the well-known school for the deaf now located at Margate.

William Thornton (1759–1828) is reputed to have been the first American to teach the deaf to speak; his book on the subject, "Cadmus" (1793), won a medal from the Philosophical Society. The influence of the Abbés de l'Epée and Sicard was important in introducing the sign language into America. Thomas Hopkins Gallaudet was sent from Hartford, Connecticut, in 1815, to study the methods of teaching the deaf and dumb in Europe. He first visited the school in London which had been established by Thomas Braidwood, but even at that date the methods were kept secret and inquisitive visitors were not welcomed, so that Gallaudet was obliged to proceed to Paris, where he was more cordially received by the Abbé Sicard. He returned with Laurent Clerc, a teacher from de l'Epée's institution, to set up in 1817 the American Asylum at Hartford for the Education and Instruction of the Deaf and Dumb, called later the American School for the Deaf. The name of Gallaudet has been perpetuated in Gallaudet College, the well-known institution in Washington, D.C., for the education of the deaf on a university standard.

Another pioneer in America was Alexander Graham Bell (1847–1922), who was born in Edinburgh and educated at its Royal High School and University. His father was a teacher of elocution who went out to Canada and the United States and lectured on his system of phonetics and "visible speech". Young Bell became a teacher of phonetics in Boston, where he was so successful with a small deaf-mute boy that the boy's father offered to subsidize and patent his inventions. His efforts to transmit speech by the aid of electricity, for the benefit of the deaf and particularly of his deaf wife, led to his invention of the telephone in 1866—and eventually to the development by others of the electric hearing-aid and the audiometer. In 1880 he received the Volta Prize of 80,000 francs (which had been established by Napoleon in 1800 for important contributions to the new science of electricity) in recognition of his invention of the telephone, and in 1887, having become wealthy from his inventions, endowed the Volta Bureau in Washington, D.C., for the dissemination of information helpful to the deaf. He also founded in 1890 the American Association to promote the Teaching of Speech to the

Deaf, with which the Volta Bureau is associated. The American Hearing Society (formerly the American Society for the Hard of Hearing) is a federation of local organizations for the hard of hearing, concerned both with children and adults, and has its office in the Volta Bureau Building.

Denmark was the first country to introduce the compulsory education of deaf children, in 1817. In 1890 the Education of Blind and Deaf-mute Children (Scotland) Act was passed, followed in 1893 by a similar Act for England and Wales, making elementary education for the deaf compulsory, grants being given by the education authorities. The 1944 Education Act has similarly made secondary education compulsory for deaf and dumb children as well as other children. In 1884 a College of Teachers of the Deaf was incorporated (at the instance of the teachers themselves), and now grants a diploma approved by the Board of Education; the specialized training of the teachers is carried out in a special department of the University of Manchester. The National Institute for the Deaf, the central organization in London for the welfare of deaf-mutes, the deafened and the hard of hearing, was founded by Leo Bonn in 1911 as the National Bureau for Promoting the General Welfare of the Deaf, and reconstituted under its present name in 1923.

CHAPTER VII

LARYNGOLOGY IN THE NINETEENTH CENTURY

MEDICINE shared with other sciences in the freeing of human thought, writing and speech from the dead hand of Authority brought about in the eighteenth century by the writings of Rousseau and Voltaire and finally by the French Revolution of 1789, and the ideas which influenced laryngology in the first half of the nineteenth century had therefore their origins in the eighteenth.

ANATOMY AND PHYSIOLOGY OF THE LARYNX

The anatomy of the larynx had been correctly portrayed previous to this period, but the action of the laryngeal muscles and the production of the voice were understood imperfectly and inconclusively. Xavier Bichat, of Paris, who unfortunately died at the age of 30, was the first to emphasize, in 1802, that the physiology and pathology of the different tissues should be studied, as well as the character of the lesion, as opposed to the study previously of diseases merely according to their mere anatomical situation, the head, the abdomen and so on. Bichat discussed the functions and morbid conditions of the nasal mucosa, questioned whether ozaena was a true ulceration, as was believed, and wrote of the liability of the mucous membrane of the larynx to become engorged with serum during inflammation. He had a considerable influence upon Bretonneau and his successors, and even upon Virchow. A publication of some note, in 1809, was the "Anatomico-Chirurgical Views of the Nose, Mouth, Larynx and Fauces", by John James Watt, because, in addition to an accurate anatomical description of the parts, it contains the first coloured plates of the anatomy of the nose and throat.

François Magendie (1783-1855), Professor of Medicine at Paris, published some interesting experiments in 1813 on the physiology of the larynx, primarily as to the purpose of the epiglottis. He removed the epiglottis completely in various animals, and found not the least difficulty consequently in their

swallowing either solids or liquids. By making an opening in the throat he saw that the larynx closed completely during deglutition, and this act was scarcely interfered with on section of both recurrent laryngeal nerves ; but when both superior nerves were cut the cartilaginous glottis was not shut, though not until the four nerves were divided did the animals really experience great difficulty in swallowing. In 1829 Robert Willis of Cambridge proceeded to examine the mechanism of the crico-arytenoid joint and recognized definitely that the motion of the arytenoid cartilages was chiefly one of rotation, in opposition to earlier beliefs. He showed that the crico-thyroid muscles must necessarily produce tension of the vocal bands, that the thyro-arytenoid muscles would have the reverse effect and relax these ligaments, that the posterior crico-arytenoid muscles rotate the arytenoid cartilages so as to separate the vocal processes and with them the vocal bands, that the lateral crico-arytenoid muscles, on the contrary, rotate those cartilages until the vocal processes touch anteriorly, thus bringing the vocal bands into apposition, and, finally, that the transverse arytenoid muscle approximates the bodies of the arytenoid cartilages so as to close the glottis completely when acting in conjunction with the lateral crico-arytenoid muscles. John Reid, Professor of Medicine at St. Andrews, in 1838 showed conclusively that the superior nerve supplies sensation to the larynx and the recurrent nerve supplies movement, except in the case of the crico-thyroid muscle. In 1837, as Reid remarked, John Hilton of Guy's Hospital had from anatomical considerations alone announced views as to the laryngeal nerves very nearly in accordance with those experimental results. Very perfect dissections of the nerves of the body were made by Joseph Swan of London, about 1830 ; among the rest he displayed the laryngeal nerves in several large and well-finished lithographs with unusual minuteness and accuracy.

The existence of an epithelial covering of mucous and other membranes was doubted until 1838, when Jacob Henle, then Professor of Anatomy at Zürich, as a result of the advances in the construction of microscopes, proved that it is the invariable covering for all surfaces of the body. He noted three kinds of epithelium —namely, pavement, cylindrical and ciliated, that of the larynx belonging to the last class, which is the same as the cylindrical with the addition of ciliae. He stated that these are most evident in the larynx on the anterior wall, while on the posterior wall and sides they only commence immediately above the superior vocal

ligaments. As Henle remarks, however, the ciliae in the respiratory tract had been previously noticed by Valentin and by Purkinje.

Although Galen called the larynx the "principalissimum organum vocis" and wrote a (lost) treatise on the voice, and Ambroise Paré observed, "When the cartilages are open the voice is large like the *basse-contre*, on the contrary, when they are compressed, the voice is shrill", it was Claude Perrault (1613-88) who first explained voice production by mechanical laws, showed that the trachea had no immediate part in it, and insisted on the contrary that the upper parts of the air-passages took part in the formation of the voice. M. Dodart in 1700 stated that the glottis was the organ of the voice, that tones depended on the tension of the lips and its various internal structures, and that the concavities of the mouth and the nose only modified the production of the voice. A. Ferrein, in 1742, was the first to apply the name "vocal cords" to the lips of the glottis and saw in them the principal instruments for the modification of the voice. Haller, in 1761, discussed the part played in voice production by the various structures of the nose and throat, and suggested that the accessory nasal sinuses made the voice more resonant. Magendie, as has been noted, saw by his experiments the vibration of the vocal cords actually taking place in animals, and compared their action to the vibrating reeds of wind instruments. He believed that the tones of the voice depended not so much on the tension of the vocal cords as upon the length of their vibrating surfaces, deep tones being due to the vibrating of the whole length of the cord, and high notes to the vibrations of the posterior portions only of the cords, varying with the height of the note. He also noted the modifications of the voice by the cavities of the mouth and the nose, but believed the epiglottis to have something to do with voice production. The mechanism of the falsetto voice had long been an obscure matter, affording much argument, but in 1835 Carl Lehfeldt pointed out that the falsetto tones emanated from the larynx alone and that they were formed by the vibration being restricted to the edges of the vocal cords. He was led to this opinion by observing in experiments that a gentle current of air, by giving rise to limited vibrations, produced a note one-third, one-fifth, or even an octave higher than when a full blast was directed against the vocal cords.

PATHOLOGY OF THE LARYNX

In pathology the main achievement of this period was the differentiation of the various kinds of ulceration of the larynx. Morgagni in the eighteenth century confused tuberculous with syphilitic ulcerations of the larynx, but Matthew Baillie in 1793 observed post-mortem appearances in the lungs which he described as "tubercles", and in the edition of his book published in 1825, after his death, are described inflammation and ulceration of the tracheal mucosa "where there are scrofulous abscesses of the lungs", and the same appearances are observed in the mucous membrane of the larynx. Gaspar Bayle in 1810 had described three stages of pulmonary phthisis—the state of tubercle, then its softening, last the cavernous stage, and Laennec, in his treatise on diseases of the chest, wrote a very complete description of phthisis, saying, "The existence in the lungs of those peculiar productions, to which the name tubercle has been restricted by modern anatomists, is the cause and constitutes the true anatomical character of consumption" (English translation, 1823), and also described laryngeal phthisis. Broussais published in 1816 his observations of white miliary tubercles in the larynx and an ulceration in the ventricles of the larynx, in a man dead of pulmonary phthisis. But the idea of tubercles being developed in the mucous membrane of the larynx and producing ulceration by their softening was first clearly expressed by C. J. Pravaz in 1824, and in 1825 P. C. A. Louis, physician to the Hôtel-Dieu in Paris, as a result of his many post-mortem observations, stated that "ulcerations of the larynx, and especially those of the trachea and epiglottis, must be considered as lesions proper to phthisis". Richard Bright (1789–1858) of Guy's Hospital spent as much of his time in the post-mortem room as in his hospital wards, and in 1836 gave an accurate description of laryngeal phthisis; he also pointed out the connection between tonsillitis and Bright's disease. W. H. Porter (1790–1861), in his "Observations on the Surgical Pathology of the Larynx and Trachea", published in 1826, reflects the pathological knowledge of the times.

The most valuable work, however, was that of Armand Trousseau and J. H. Belloc, published in Paris in 1837, entitled "Traité pratique de la phthisie laryngée, de la laryngite chronique, et des maladies de la voix". They made four separate divisions of "laryngeal phthisis": (1) simple laryngeal phthisis (severe or

hypertrophic chronic laryngitis); (2) syphilitic laryngeal phthisis; (3) cancerous laryngeal phthisis; and (4) tuberculous laryngeal phthisis. Their differentiation was obviously still far from perfect and examination of their case reports shows considerable confusion, but their differential diagnosis, especially of the last two classes, is much in advance of any of their predecessors. In 1846 Rokitansky, the great pathologist on the basis of whose enlightened descriptions of 30,000 necropsies were built the foundations of the Vienna school of medicine, published his handbook of pathology, giving an accurate description—among much else—of the morbid anatomy of tuberculous processes in the larynx, to which but little has since been added.

In the eighteenth century John Fothergill of London as “malignant angina” had possibly and Francis Home of Edinburgh as “croup” had certainly described diphtheria, and John Cheyne, in 1809, wrote on “The pathology of the membrane of the larynx and bronchi” in croup; but it was not until the publication by Pierre Bretonneau of Paris (1771–1862) of his important monograph “Inflammations spéciales du tissu muqueux et en particulier de la diphtérite” in 1826, which is one of the landmarks in the history of diseases of the throat, that any marked advance was made in the study of this disease, to which Bretonneau gave its name. “From the impossibility”, he wrote, “of applying to a special inflammation, so well defined, a single one of the names which have been given to its variations, allow me to designate this phlegmasia by the name Diphtérite, derived from the Greek διφθέρα, which means a skin, an exuvium.” On July 1st, 1825, he had performed tracheotomy for laryngeal diphtheria, and believed that this was the first case in which the operation was successfully done, though it is probable that some of the successful tracheotomies of the seventeenth and eighteenth centuries were done for diphtheria under the name of “angina”. Bretonneau also succeeded in passing a probang with a sponge over the aryteno-epiglottic ligaments to express fluids into the larynx, though Troussseau vehemently denied that he—or others—could reach the interior of the larynx in this way.

Frederick Ryland of Birmingham published, in 1837, his “Treatise on the Diseases and Injuries of the Larynx and Trachea”, founded on his Jacksonian Prize essay for 1835. Its contents comprise the anatomy and pathology of the larynx, acute laryngitis, oedema of the glottis, erysipelatous laryngitis, chronic

laryngitis, croup, diphthérite, spasm of the glottis, hysterical affections of the larynx, tumours of the larynx and trachea, wounds and injuries of the larynx and trachea, foreign bodies in the air-passages. Only eight pages (out of 328) were devoted to tumours of the larynx and trachea—"hydatids" (probably oedematous swelling), polypus, cartilaginous tumours, medullary sarcoma, "warty tumours" and other excrescences (their origin ascribed to "a syphilitic taint"). "The presence of polypus of the larynx", wrote Ryland, "is not indicated by any very characteristic signs, and consequently the disease is seldom discovered till after death. . . . If it were possible to ascertain the existence of a polypus in the larynx during life, it would be the duty of the surgeon to attempt its removal by the knife or by a ligature round its base, but I am not aware of any case in which this operation has been undertaken." Ryland observed that acute laryngitis belonged to that class of diseases that had received the generic name of cynanche or quinsy, diseases that had been known and distinguished from the earliest ages. George Washington, he noted, died of acute laryngitis. Frederick Ryland's treatise is a clear exposition of diseases of the larynx as known before the invention of the laryngoscope; he gives clinical details of cases, with post-mortem reports on the appearances in the larynx, and includes some excellent plates. Morell Mackenzie had such a high regard for the work of Ryland that he dedicated his "Use of the Laryngoscope" (1865) to his memory.

EARLY OPERATIONS ON THE LARYNX

In the pre-laryngoscopic era growths of the larynx, simple or malignant, were seldom diagnosed except at necropsy, and of course rarely operated upon. G. Köderik, a surgeon at Brussels, was reported in 1770 (by Herbiniaux in the "Journal de Médecine", Paris) to have ligated a laryngeal polypus by means of an instrument constructed out of a row of hollow balls. Semeleider in 1863 recorded that Pratt (of whom nothing more is known) performed sub-hyoid laryngotomy for the removal of a fibrous tumour from the under surface of the epiglottis. J. C. Cheeseman in 1817 was apparently the first in America to describe and illustrate (in the "Transactions" of the Physico-Medical Society of New York) a laryngeal growth; the patient died from papilloma of the vocal cords. Sir Astley Cooper was a pioneer of the surgery of the

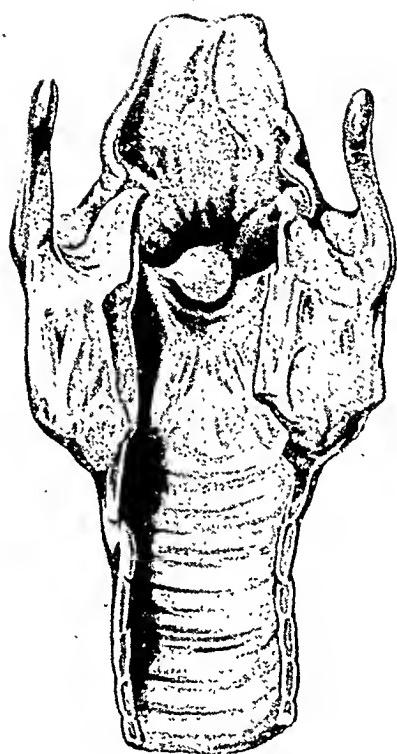
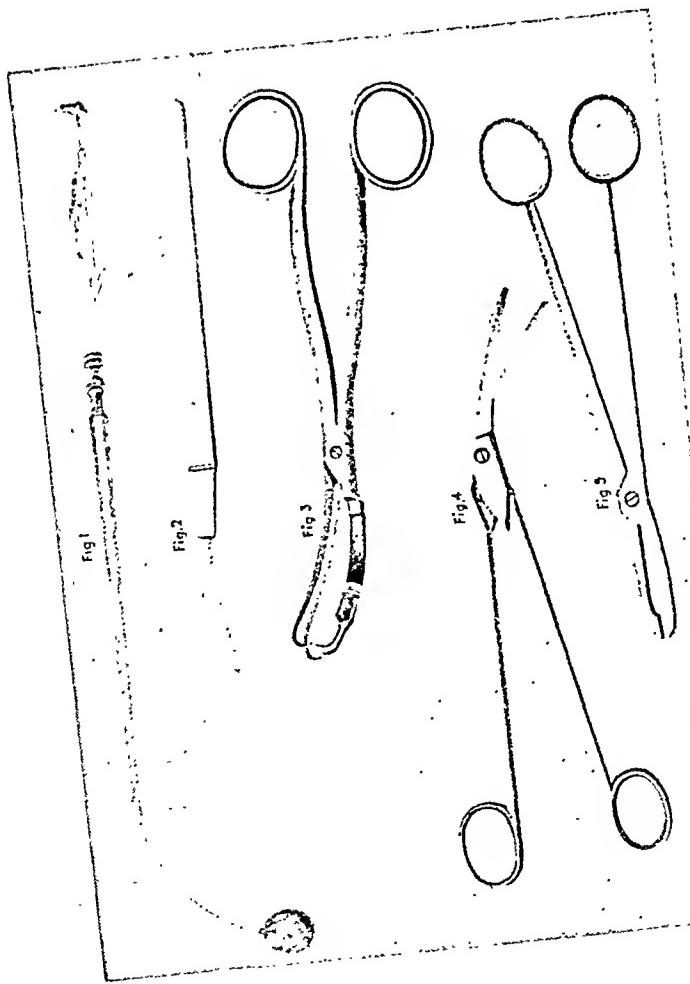


FIG. 33
Polypus of the Larynx
(Plate from Ryland's "Treatise on the Diseases and Injuries of the Larynx and Trachea," 1837)



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FIG. 34. Horace Green's "Treatise on Diseases of the Air Passages". New York (1846). Fig. 34. Horace Green's "Treatise on Diseases of the Air Passages". New York (1846).

FIG. 3.—From Horace Green—*The larynx—the rou* is *the* *larynx*.
Fig. 3, forceps for holding the uvula while applying silver nitrate solutions to the tonsils.
Fig. 2, knife for excision of tonsils.
Fig. 5, forceps for truncating the uvula.
Fig. 4, forceps attached at the end, for holding the uvula while applying silver nitrate solutions to the tonsils.

Fig. 1, instrument for applying - attached at the end. Fig. 2, curved scissors, for truncating the round piece of fine sponge. Fig. 4, curved scissors made with the scissors from between the pillars of the fauces.

Fig. 25.—From Horace C. M. Smith's "Diseases of the Mouth," p. 122.
"The mouth being open, and the tongue depressed by the coughing momentarily, as it was revealed momentarily, by the depression of which (A) is seen a small portion of the polypous tumour after its removal by a division of its pedicle."

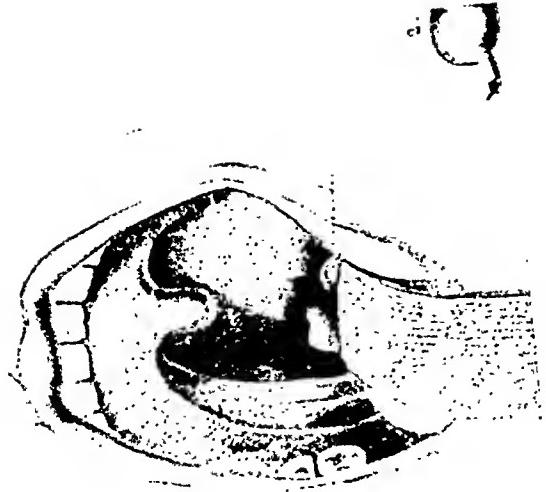


Fig. 35

throat as well as of the ear, and (according to Frederick Ryland) performed "bronchotomy" for acute laryngitis. Morell MacKenzie (in his "Use of the Laryngoscope") describes how Cooper removed with his finger a large cancerous tumour, about the size of a hen's egg, from the under surface of the epiglottis. It grew again and was again removed, and the patient finally died from haemorrhage; the specimen was preserved in the museum of Guy's Hospital, but on reference to the old catalogue has been found to be marked "T.A."—thrown away! Albers of Bonn stated in 1834 that "tumours in the cavity of the larynx belong to a class remarkable alike for their rarity and their characteristic symptoms", and reported a death in 1833 from asphyxia caused by a malignant tumour the size of a nut; he apparently experimented on dogs to test the feasibility of laryngectomy after tracheotomy. Trousseau and Belloc in 1837 could report from the literature and from their own experience only seven cases of intra-laryngeal tumour.

Desault of Paris, in 1810, is said by Sprengel to have been the first to open the larynx, splitting the thyroid cartilage in a patient in whose larynx a foreign body was impacted, and Arthur Durham in 1872 still speaks of Desault's operation, called by Desault "laryngotomy"; in 1833 Brauers of Louvain cut through the thyroid cartilage of a man aged 40, apparently to cauterize papillomata; and in 1844 Ehrmann, of Strasbourg, who pointed out that "polypi of the larynx, left to nature, become sooner or later the cause of sudden death", removed a polypus of the larynx in a woman aged 33 by first performing a tracheotomy, and two days later cutting through the thyroid cartilages. Up to the year 1850 Ehrmann found thirty-one cases of laryngeal tumour reported in the literature, including his own. Middledorpf of Breslau, in 1853 removed, by means of an incandescent wire loop, a polyp which he believed to come from the upper part of the larynx; he pulled forward the tongue forcibly by a sharp hook, with his fingers insinuated the wire loop round the tumour, and then turned on the current.

The surgeon who first performed laryngectomy was Patrick Heron Watson (1832–1907) of Edinburgh, in 1866; it was done for syphilis of the larynx, not cancer, and the patient died of pneumonia. Christian Theodor Billroth (1829–94), born at Bergen, educated at Berlin, and Professor of Surgery at Vienna, was the first to remove the larynx for cancer in 1873, but recurrence

and death took place in a month ; actually the first larynx removed by Billroth was found, when it was split open, to be tuberculous, not cancerous. Billroth also performed the first resection of the oesophagus, in addition to many contributions to gastric surgery.

AMERICAN PIONEERS

In America, the first case report in the first volume of the "Transactions of the American Medical Association", published in 1848, is an illustrated account of the procedure and instruments for scarification of the upper aspect of the larynx in oedema of the glottis, as performed in 1846 by Gurdon Buck (1807-77), a general surgeon of New York. Buck was also the first surgeon anywhere to perform a successful thyrotomy for the removal of a laryngeal cancer ; the operation was done in May 1851, at the old New York Hospital, and the patient lived until August 4th, 1852. J. Solis Cohen (1838-1927), of Philadelphia, was the next to repeat the operation, in 1868, curing his patient, whom he exhibited in 1887 in excellent health and with a fair voice. Solis Cohen was also the first to perform laryngectomy in America. At this time the accepted method of removing foreign bodies from the air or food-passages was by the blind passage of a bristle probang or a coin-catcher with a flexible whalebone shaft. Mussey, however, in the "Transactions of the American Medical Association", in 1850, reported the removal of a cockleburr from the larynx by performing thyrotomy and forcing the burr upwards by his finger passed through the operation wound.

The pioneer throat specialist of America was, however, Horace Green (1802-66), who published in 1846 his "Treatise on Diseases of the Air Passages, Comprising an Inquiry into the History, Pathology, Causes and Treatment of those Affections of the Throat called Bronchitis, Chronic Laryngitis, Clergyman's Sore Throat, etc.", and who, on the title-page, describes himself as "Formerly President and Professor of the Theory and Practice of Medicine, in the Castleton Medical College". Horace Green was an interesting character, who was one of the founders of the New York Medical College in 1850. He was one of the few to remove a laryngeal tumour before the invention of the laryngoscope ; when the patient opened his mouth widely and coughed, a round white fibrous-looking tumour, about the size of a cherry, could be seen arising from the larynx ; Green succeeded in seizing it with tonsil

forceps and dividing it with a long slender knife. He published a book, "Polypi of the Larynx", in 1852. Before his time it was considered impossible to introduce any instrument into the larynx, and when Green said in 1838 that he had applied a silver nitrate solution (he used 40 to 80 grains to the ounce) within the larynx with a curved applicator, his statement was received with incredulity. He was attacked with surprising savagery, forced to resign from the medical society to which he belonged, and threatened with expulsion from the Academy of Medicine. He undoubtedly did good to some cases of chronic laryngitis, but he was optimistic enough to think that silver nitrate could also heal tuberculous cavities in the lungs. It was not the first time nor the last—for technique is the lure of the surgeon—that a surgeon in introducing a new technique has been led to believe that thereby he has brought about a cure in an intractable disease. Green quoted Frederick Ryland in his support: "The idea of the aperture of the glottis being closed by the abasement of the epiglottis upon it", said Ryland, "has long been exploded, and it is now well known that a tube . . . will, if directed by a scientific hand, readily find its way into the trachea".

Horace Green says, in the "Introduction" to his "Treatise", that in September 1840 he brought before the New York Medical and Surgical Society the subject of the treatment of disease of the larynx, by means of the direct application of therapeutical agents to the lining membrane of that cavity. He then exhibited instruments by means of which topical remedies were applied to the larynx, and reported fifteen cases of laryngeal and bronchial disease in which permanent cures had been effected by this mode of treatment. Such, however, was the degree of scepticism on this subject manifested at the time by a large proportion of the members that for many years he refrained from bringing the matter again before the Society. At length the subject was again presented to the Society by some of its members, and a Committee was appointed to enquire more fully "into the practicability of making these topical applications to the surfaces of the larynx". This committee, after devoting much time to the investigation of the subject, reported in favour of the entire practicability of the operation.

Another American pioneer of note is Joseph P. O'Dwyer (1841-98), born in Cleveland, Ohio. Although unknown to him, intubation for dyspnoea dated back to the days of Hippocrates, when physicians apparently passed tubes beyond the fauces,

though how much farther is uncertain. References to the manœuvre persist through the medicine of the Renaissance, but the first clear description is by Bichat, who described how Desault gave relief to a suffocating patient by passing a hollow sound into the larynx, and Bouchat of Paris in 1856 urged its employment in laryngeal diphtheria. O'Dwyer, after long, patient and persistent endeavours, published an account of his successful method of intubation in diphtheria in 1885, which undoubtedly saved the lives of many children, though the introduction of diphtheria antitoxin by Behring in 1890-93 greatly diminished the number of cases requiring intubation or tracheotomy.

THE NOSE AND NASAL SINUSES

The first separate treatise on the nose and nasal sinuses was that of J. F. L. Deschamps (1740-1824) of Paris in 1804, extending to 300 pages. He devoted a good deal of attention to the sense of smell and stated that the sinuses had nothing to do with olfaction (in opposition to Magendie in 1817). He divided nasal polypi into (1) fungous and vascular, (2) mucous and lymphatic, (3) scirrhous, and (4) sarcomatous ; and his methods of treating them were (1) local astringents, (2) excision with a guarded bistoury, (3) avulsion by forceps, (4) the ancient knotted thread (which he ridiculed), (5) chemical caustics and the actual cautery, and (6) ligation with a waxed thread and silver wire. He recognized the symptoms of acute frontal sinusitis, described simple inflammation and suppuration of the maxillary sinus, and advised treating the latter by opening the sinus through the alveolus of a bad tooth, if one were present, or through an opening above the alveolar border large enough to introduce a finger. He did not mention deviations of the nasal septum. Hippolyte Cloquet (1787-1840) in 1821 published an even larger work of 750 pages on the nose, which professed mainly to deal with the physiology of olfaction, and only incidentally with affections of the nose. He described deviations of the nasal septum, which he believed to be irremediable, dealt fairly adequately with fractures of the nose and rhinoplasty, and less adequately with rhinitis and other nasal diseases. In 1832 George Catlin, the explorer and painter, wrote his treatise on "mouth breathing", based on his observations of the habits of North American Indians, which can still be read with interest.

Langenbeck, in 1842, was apparently the first to describe so-called ecchondroses and exostoses of the nasal septum as septal crests and spurs, and Theile, in 1855, showed the frequency of deviations of the nasal septum, but it was not until Adams, in 1875, had recommended the forcible fracture of the septum and its subsequent support by splints, that surgery was applied to the nasal septum. The discovery of cocaine as an anaesthetic in 1880 by Anrep and its introduction into laryngology by Jelinek in 1884 gave a great impetus to the surgery of the nose, aided by the isolation of adrenaline in a chemically pure form in 1901 by Takanini and independently by Aldrich. The operation on the septum described by Asch in 1890 was widely practised, especially in America, but in essentials it was based on the forcible fracture method of Adams. Burkhardt, Krieg and others pointed out the value of leaving the mucous membrane intact on one or both sides of the septum when removing cartilage, but it was Boenninghaus in 1899 and Killian in 1900 who made the modern submucous resection of the nasal septum practicable. W. J. Walsham (1847–1903) of London, although a general surgeon on the staff of St. Bartholomew's Hospital, was one of the pioneers of rhinology, wrote a book (1897) on nasal obstruction, and devised operations on the nasal septum.

Although Spencer Watson, in 1875, and Lennox Browne, in 1878, had published textbooks on diseases of the nose, even Morell Mackenzie in his classical "Diseases of the Throat and Nose" in 1880–84 hardly discussed the nasal sinuses and their diseases, and suppuration of the maxillary antrum was still associated with the teeth rather than with the nose. Greville Macdonald in his "Diseases of the Nose" in 1890 was concerned more with olfaction and hay fever than with nasal sinusitis; he merely mentioned the frontal sinus and treated maxillary sinusitis in the traditional manner. It remained for Grünwald in his textbook on "Nasal Suppuration" in 1893 (English translation in 1900) to establish the subject of sinus disease on a secure foundation, and for Onodi of Budapest in 1900 by his beautiful anatomical preparations to demonstrate the important relationships of the sinuses and clear up many obscure points regarding them.

The radical operation on the maxillary antrum through the canine fossa dates back to Lamorier in 1743 and Desault (who used a sharp triangular perforator) in 1798, but it was Küster of Berlin who in 1889 re-established the method and applied modern surgical

principles to it. All the modern radical antrum operative methods are only modifications of the Desault-Küster procedure; but the use of the prosthesis, or rubber-stopper, made the after-treatment very disagreeable—it acted as a foreign body and kept up the discharge, so that this method has been abandoned. G. Caldwell of America (1893) and Luc of France (1894) independently suggested opening widely into the canine fossa and then establishing a permanent counter-opening into the nasal cavity; this operative procedure is therefore called the Caldwell-Luc method, although Scanes Spicer of London (1894) also independently devised a similar operation about the same time. Modifications of the Caldwell-Luc operation concern chiefly the formation of the nasal opening and transplantation of a flap of mucous membrane into the antrum—Boenninghaus, Hajek, Denker and others have designed such operations.

As early as 1750 Runge is said to have opened and obliterated the frontal sinus, but the modern operation dates from Alexander Ogston of Aberdeen in 1884. In his first case Ogston made an angular incision, a vertical cut between the eyebrows meeting a horizontal one parallel to the wrinkles of the forehead, and having raised skin and periosteum he applied a trephine to the bone and made an opening large enough to expose the interior of the sinus. In subsequent cases he made his incision one and a half inches long, beginning at the root of the nose and extending upwards over the nasal eminence of the frontal bone in the central line of the forehead; Luc designed a similar operation, and the method became known as the Ogston-Luc operation. In 1895 Killian described an operation on the frontal sinus designed to avoid deformity; he made his incision through the eyebrow and preserved the upper orbital arch, but obtaining complete exposure of the frontal sinus and also, by prolonging the incision, of the ethmoid cells. Many other external operations were suggested and performed, but Killian's method was largely accepted and practised, until it was gradually found that it did not always produce a complete cure, that it did not always avoid deformity, and that osteomyelitis of the frontal bone sometimes resulted. Jansen, as an assistant in Lucae's clinic, described in 1894 the cardinal principles and technique of the modern frontal sinus operation, approaching the frontal sinus from the orbit, with easy access to the ethmoid, and a good cosmetic result. Herbert Tilley of London in 1896 studied the surgical anatomy of the frontal sinus

and urged the external operation, which was practised by E. B. Waggett and others.

As regards the pathology of nasal polypi, even in 1852 Chelius (in his "Handbuch der Chirurgie") still looked upon them as a local infiltration of the mucous membrane with serum, a conception which dates back to the Middle Ages; Billroth in 1854 described nasal polypi as adenomatous; Virchow in 1863 called them myxomata, and Morell Mackenzie in 1884 was content to follow the lead of Virchow. Edward Woakes of London, in 1885, was the first to suggest that nasal polypi arose from a chronic infection of the ethmoid cells, but he pushed his conception of "necrosing ethmoiditis" to an extreme degree.

THE TONSILS

The gross anatomy of the faucial tonsils had been studied and described from the earliest times, but Kölliker of Brussels in 1852 was the first to study their structure with the microscope. He described the follicles in their walls and the epithelium, and believed them to be part of the lymphatic system and related to the Malpighian corpuscles of the spleen. The finer structure of their lymphatic network was more precisely investigated by His in 1862; later Waldeyer, in 1884, pointed out the still imperfectly understood arrangement of lymphoid tissue around the intersection of the air and food passages.

The ancient surgeons—as well as the modern—had a wholesome respect for the dangers of haemorrhage in operations on the tonsils. Heister, in Germany in 1743, differentiated the following methods of operating: (1) application of corrosives; (2) abscission according to the methods of the ancients; (3) ligation, using the apparatus of Hildanus for the uvula. A method attributed to Cheselden was to pierce the tonsil with a double-threaded needle, and tie off each half of the tonsil in a ligature. Benjamin Bell in 1784 employed his double cannula snare, previously used for nasal polypi, for ligation of the tonsils. Desault in 1798 performed tonsillotomy with his uvulotome, but also was accustomed to make use of a ligature around the tonsil, which he tightened daily for a day or two until the tonsil fell off.

Philip Syng Physick (1768–1837) of Philadelphia, an Edinburgh graduate of 1792, sometimes called the "Father of American Surgery", published in 1820 an account of the method which he

employed for the removal of "scirrhous" tonsils by means of strangulation with a soft wire carried round the tonsil by a double cannula. In 1828, however, Physick modified an instrument, designed by Benjamin Bell as a uvulotome, which he used as a tonsillotome, and which is the progenitor of all tonsil guillotines. Physick's tonsillotome had two plates, with a knife sliding between them; a strip of waxed linen was passed round the posterior semi-circumference of the aperture, so as to obviate not cutting clean through the tissues, the waxed linen supporting and holding them. By increasing the size of the aperture in the guillotine he found that he could adapt it to the removal of the tonsils. Physick wrote of the operation that it is "easy to cut off the whole or any portion that may be necessary of the enlarged tonsil in this manner. The operation can be finished in a moment of time. The pain is very little, and the haemorrhage so moderate that it has not required any attention in four cases in which the doctor has lately performed it." Physick's method was eagerly taken up by many of his American colleagues, several of whom devised modifications of his instrument. William B. Fahnstock introduced a guillotine with a prong or fork to catch the tonsil, which, somewhat modified, became known in France as Mathieu's guillotine and maintained its popularity up to the first years of the present century. But Morell Mackenzie in the sixties should be regarded as the true founder of the modern tonsil operation. His guillotine was a modification of that devised by Physick, but with many improvements, and in his skilful hands the technique of the operation was greatly improved. He did much to popularize the operation by the excellent results achieved by his methods; indeed until the early years of the twentieth century the guillotine remained the favourite instrument for the removal of the tonsils throughout the world.

RECOGNITION OF ADENOIDS

Kölliker in 1852, in describing the faucial tonsils, mentioned the existence of similar tissue in the nasopharynx, Henle in 1866 insisted that the "pharyngeal bursa" was a normal structure, and Luschka in 1868 described fully the median and lateral recesses of the pharyngeal tonsil. James Yearsley of London, as has been noted, in 1842 removed mucous membrane from behind the uvula to improve the hearing, and Czermak and Voltolini introduced posterior rhinoscopy (1859-61), but it was Hans Wilhelm

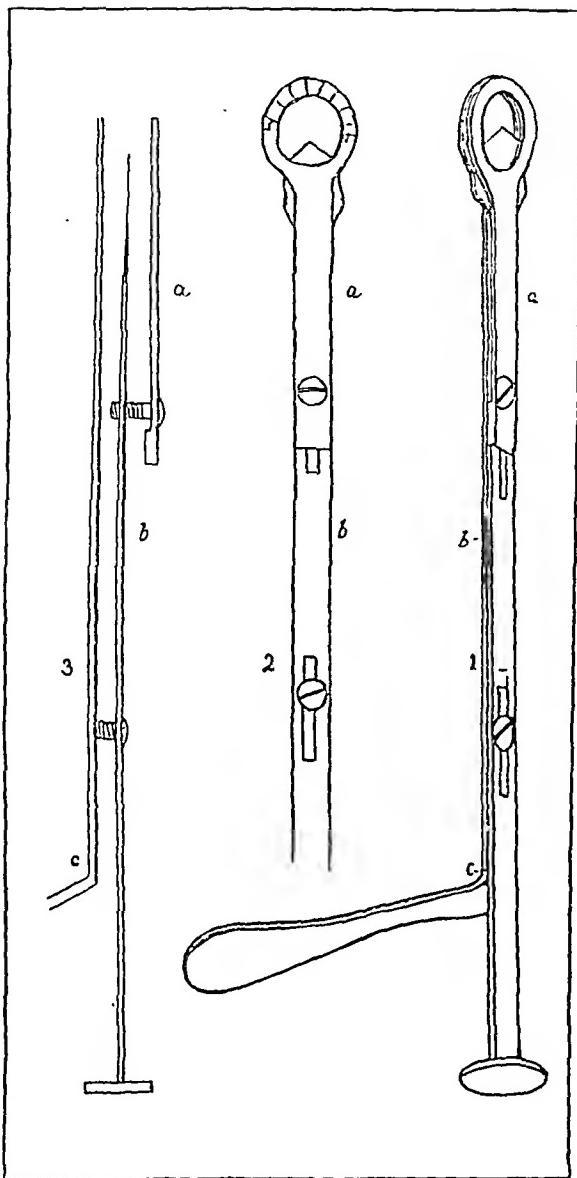


FIG. 36
The tonsillotome of Philip Syng Physick (1828)

Meyer (1824-95), of Copenhagen, who in 1868 first described adenoids ; his paper "On Adenoid Vegetations in the Nasopharyngeal Cavity" appeared in several languages, first in the Danish "Hospitaltidende", and in "Medico-Chirurgical Transactions" in London in 1870. In the course of examining a young patient for a possible cause of deafness associated with nasal obstruction, Meyer pushed his finger up into the nasopharyngeal space and became aware of the presence there of an abnormal growth ; once his attention had been drawn to it, he recognized the condition as so common that he found it present in 102 cases during the next eighteen months. He described the signs and symptoms of adenoids so fully that any doctor, however inexperienced in rhinoscopy, was able to suspect and detect their presence at once. Guye of Amsterdam in 1884 emphasized the influence of adenoids in retarding the development of a child's mentality, giving this symptom the name of "aproxexia". Meyer was accustomed to remove adenoids with the aid of a ring-knife, others employed the index finger with a "steel nail" upon it ; but later Störk's choanal forceps and (in 1885) Gottstein's curette came into use and have since been modified in design by various surgeons. The operation was at first performed without any anaesthetic, but in the early nineties it began to be realized that general anaesthesia was beneficial to patient and surgeon alike. A statue was erected to Wilhelm Meyer in the Gefion Plads of Copenhagen in 1898.

THE PRE-LARYNGOSCOPIC PERIOD

The idea of examining the larynx had been in the minds of many men long before Garcia's successful demonstration in 1854. Morell Mackenzie, in the historical survey in his book "The Use of the Laryngoscope", goes a little too far, however, when he states that Celsus in the Augustan Age used a dental mirror to examine the throat—he confused the word *speculum*, a mirror, with *specillum*, a probe ; and that Levret, an eighteenth-century French surgeon, used a polished steel plate to examine the throat—it was only a polished steel tongue depressor. In 1807 Bozzini of Weimar published a description of an instrument for examining the throat. It consisted of a speculum divided with a vertical partition, so that there were in fact two canals and two mirrors ; one of the mirrors was intended to convey the light, the other to

receive the image—an arrangement which is, of course, quite unnecessary. A wax candle with a reflector supplied the illumination, but it is highly unlikely that Bozzini ever saw any part of the larynx with his speculum. L. Senn of Geneva published in 1827

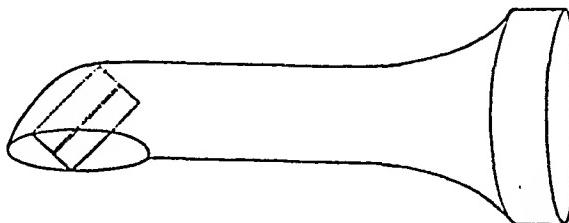


FIG. 37

Bozzini's Laryngeal Speculum (*after Hufeland*)

The speculum was divided by a vertical partition, and two mirrors were placed at its extremity. In the drawing from which this is taken, the mirrors are directed upwards, as they would be when employed in rhinoscopy.

an account of an attempt to see the upper part of the larynx with a mirror and suggested that this method might assist in the diagnosis of certain cases of laryngeal phthisis.

Benjamin Guy Babington (1794–1865) is the most interesting of those early pioneers, since he did indeed invent a laryngoscope and apparently used it on many patients in conjunction with a hand-mirror to reflect the light. Babington was born in Guy's Hospital, where his father was resident physician, and his sister married the famous Dr. Richard Bright. He made two false starts in his career, first in the Navy and then in the East India Service, but eventually took up medicine, studied at Cambridge and Guy's Hospital, and qualified in 1825. He became assistant physician and later physician to Guy's Hospital, assisted his brother-in-law, Bright, by making laboratory examinations in his study of diseases of the kidney, and busied himself with research and teaching. He was a man of scholarship and versatility, but of modest and retiring character. A Sanskrit scholar, he had made a special study of Tamil and translated a grammar and stories in that language, was the first president of the Epidemiological Society, was a Fellow of the Royal Society and was for a time a member of its Council. He possessed considerable talent in painting and sculpture and published a volume of poems. On March 18th, 1829, Babington described before the Hunterian Society of London an instrument for examining the larynx. A report of this appears in the "London Medical Gazette" (1829, vol. 3, p. 555): "Dr. Babington submitted to the Society an ingenious

instrument for the examination of the parts within the fauces not admitting of inspection by unaided sight. It consisted of an oblong piece of looking-glass set in a silver wire with a long shank. The reflecting part is placed against the palate whilst the tongue is held down by the spatula, when the epiglottis and upper part of the larynx becomes visible in the mirror. A strong light is required, and the instrument should be dipped in water, so as to have a film of fluid upon it when used or the habitus of the breath renders it cloudy. The Doctor proposed to call it the 'glottiscope'."

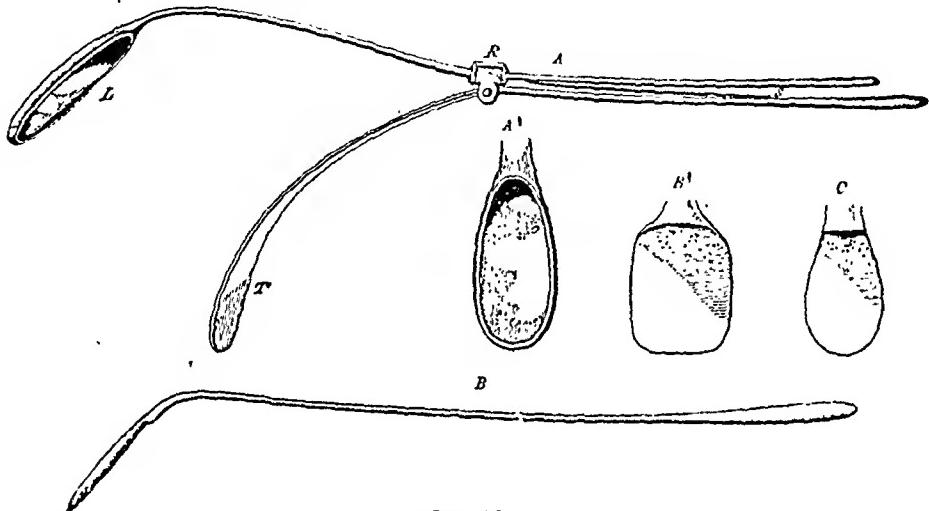


FIG. 38

Dr. Babington's Laryngeal Mirrors

A, the mirror made in 1829 ; *L*, the laryngeal mirror ; *T*, the tongue-depressor ; *R*, ring connecting the two instruments ; *S*, spring which presses the tongue-depressor down when the two handles are held together. *A'*, front view of the mirror ; *B*, the mirror made between 1829 and 1835 ; *B'*, front view of this mirror ; *C*, oval mirror made between 1829 and 1835.

(From Morell Mackenzie's "Use of the Laryngoscope")

There is no evidence, however, that Babington ever saw the movements of the vocal cords ; he recorded no cases, and he had no disciples, pupils or followers.

In 1832 Bennati of Paris asserted that he could see the vocal cords by means of a double-tubed speculum invented by a mechanic named Selligue who himself suffered from laryngeal phthisis. Troussseau, however, disbelieved Bennati's statement and devoted several pages of his book on laryngeal tuberculosis to prove that the epiglottis was an insuperable barrier to a view of the interior of the larynx. In 1838 Baumès exhibited at the Medical Society of Lyons a mirror about the size of a two-franc piece, which he described as being very useful for examining the larynx and the

posterior nares. In 1840 Robert Liston, the well-known London surgeon, in describing oedematous tumours of the larynx in his textbook on "Practical Surgery", wrote: "The existence of this swelling may often be ascertained by a careful examination with the fingers, and a view of the parts may sometimes be obtained by means of a speculum—such a glass as is used by dentists on a long stalk previously dipped in hot water, introduced with its reflecting surface downwards and carried well into the fauces". It is evident from this that Liston never contemplated an inspection of the vocal cords, and he appears in his laryngeal technique to rely more on his sense of touch than on a mirror.

In 1844 Adam Warden of Edinburgh had the idea of employing a prism of flint glass for obtaining a view of the larynx. He reported two cases in which he considered that he had had "satisfactory ocular inspection of diseases affecting the glottis". In giving the history of the first case, a lady "who had been the subject of medical treatment for chronic inflammation of the pharynx of nearly a year's duration", he wrote: "After the preliminary examination and quietening the irritability of the parts by touch with the finger there was no longer any impediment or inconvenience experienced from the tendency to retching. . . . The dilator faucium was employed to depress the tongue and expand the isthmus of the fauces." The result of the examination was that the epiglottis was seen to be very much thickened and inflamed, "but it was only when efforts to swallow were made or repeated that the arytenoid cartilages, in a similar condition of thickening, were raised out of concealment, and brought brilliantly to show their picture in the reflecting face of the mirror". For the purpose of illumination Warden employed "a powerful argand-lamp, with a large prism attached, so as to throw the full light of the lamp into the fauces and pharynx", that is to say, instead of two mirrors, one for illumination and one for reflection, he used two prisms. At the conclusion of the reports of the two cases he remarks: "The experience afforded by both gives ground for the same conclusion, that the instrument made use of can have no further range than the bottom of the pharynx and mouth of the glottis (*i.e.* the upper opening of the larynx), and of the latter only so often as it is raised from its natural depth, by the contraction of the muscles employed in the act of deglutition. By this means, therefore, we can obtain no assistance in the investigation or treatment of disease below the pharynx."

In the same year, 1844, John Avery, surgeon to Charing Cross Hospital, London, 1843–55, was seeking to examine the various canals of the body with the aid of a speculum and reflector. The "Lancet" in an obituary notice in 1855 said of Avery: "By means of his lamp-tube and reflectors he was able to examine the ear, urethra, bladder, oesophagus and larynx as probably no surgeon before him has ever examined them". In principle, Avery's laryngoscope was very similar to that now in use, and,

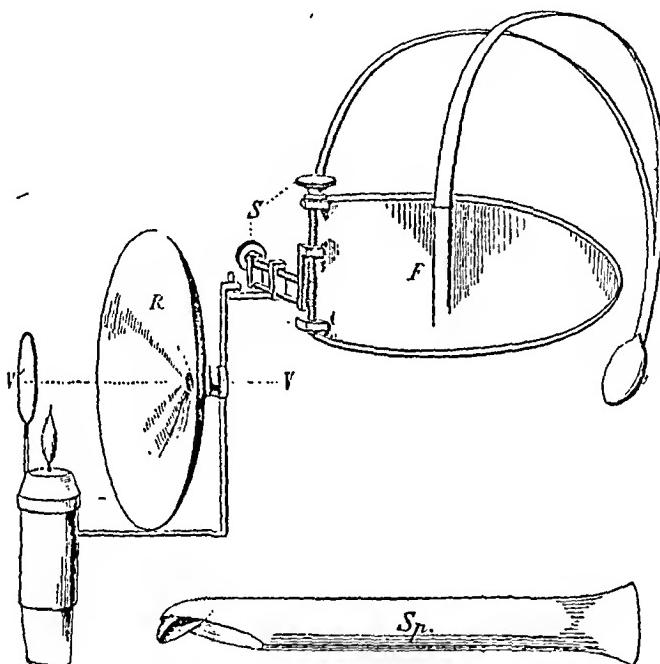


FIG. 39
Avery's Laryngoscope

F, one side of the frontal pad which supports the mirror. From it a double spring passes backwards to a counter-pad which, when the instrument is worn, rests under the occipital protuberance. In the drawing, the occipital pad is drawn forwards by the unopposed strength of the spring. *S*, screws by which the reflector can be made to move laterally and perpendicularly. *R*, reflector. *V-V'*, line of vision. *Sp*, the speculum.

like Czermak after him, he employed a large circular reflector, perforated in the centre for concentrating the luminous rays on the laryngeal mirror. The reflector was attached to a frontal pad, and this was retained in its place by two springs which passed over the operator's head to the occipital protuberance, where there was a counter-pad. There were two defects, however, in Avery's apparatus: one was that the laryngeal mirror, instead of being fixed to a slender shank, was placed at the end of a speculum; the

other, that instead of employing the reflector for receiving the rays from a lamp placed on the table or elsewhere, Avery used his large circular mirror for the purpose of increasing the luminous power of a candle held near the patient's mouth.

A piece of bent wire terminating in a circular loop projected from the candle-lamp, and was meant to steady the speculum and keep its axis in a line with the hole in the reflector. The reflector was five inches in diameter, and the apparatus which had to be worn by the operator weighed altogether nearly a pound. It was very difficult, if not almost impossible, to introduce Avery's speculum without irritating the base of the tongue and causing retching ; this alone would have been enough to ensure the failure of Avery's attempts at laryngoscopy, had not the cumbersome reflecting apparatus combined to produce the same result. Nevertheless, after the success of Garcia's laryngoscopic experiments, claims were made that Avery had anticipated him. Jabez Hogg, surgeon to the Royal Westminster Ophthalmic Hospital, wrote to the "Medical Press" in 1885 (vol. xl, pp. 265 and 339) that he well remembered "how constantly Mr. John Avery employed the laryngeal mirror at Charing Cross Hospital and how much trouble he took to explain its value to the students in his examinations of the larynx and for the performance of operations. This must have been", said Hogg, "about 1848. Avery was a man of singularly quiet and unobtrusive habits ; he, therefore, wrote but little concerning himself or his inventions and labours." Gordon Holmes was then writing in the "Medical Press" on the history of laryngology and referred Jabez Hogg to Fauvel, who had remarked that "Avery did not publish his discovery" and "nothing was known in the medical world until after Türck and Czermak". Hogg said that the reason why Avery refrained from writing at the outset was that he hoped to improve the instrument and that he was trying to produce photographs of the vocal cords and larynx, with the view of illustrating what he was preparing for publication, but at that time "the patients could not be kept in position long enough to produce a tolerably perfect picture". He fixed the date of the photographic experiments as in July 1851.

THE LARYNGOSCOPE

In the year 1848 that half-forgotten revolution swept across Europe and went on to provide the United States of America with

some of its best elements. The wave subsided at the shores of England, where the Reform Bill of 1832 and the repeal of the Corn Laws in 1846 had allayed public feeling, and to England fled King Louis-Philippe of France, leaving the Tuileries in a hired four-wheeler cab, disguised with a pair of goggles and by shaving off his whiskers. Among the refugees from the mob who followed the King across the Channel was a professor of singing at the Paris Conservatoire, of Spanish origin, Manoel Garcia by name. Garcia settled in London as a teacher of singing and did not return to Paris for five years. One afternoon in September 1854, however, Manoel Garcia was on holiday in Paris and, strolling in the garden of the Palais-Royal, observed the flashing of the sun in the window-panes of the seventeenth-century quadrangle. Prompted by Felix Semon, he told the story in his own words, as follows, in the "Transactions" of the Section of Laryngology of the International Congress of Medicine in London, in 1881 : "Preoccupied with the ever-recurring wish so often repressed as unrealizable, suddenly I saw the two mirrors of the laryngoscope in their respective positions, as if actually present before my eyes. I went straight to Charrière, the surgical-instrument maker"—Mewburn Levien, who knew Garcia well, tells in his monograph on the Garcia family that it was Garcia's friend Cavaillé-Col, the Parisian organ-builder, who sent him to Charrière—"and asking if he happened to possess a small mirror with a long handle, was informed that he had a little dentist's mirror, which had been one of the failures of the London Exhibition of 1851. I bought it for six francs. Having obtained also a hand mirror I returned home at once, very impatient to begin my experiments. I placed against the uvula the little mirror (which I heated in warm water and carefully dried) : then, flashing upon its surface with the hand mirror a ray of sunlight, I saw at once, to my great joy, the glottis wide open before me, and so fully exposed that I could perceive a portion of the trachea. When my excitement had somewhat subsided, I began to examine what was passing before my eyes. The manner in which the glottis silently opened and shut, and moved in the act of phonation, filled me with wonder."

Garcia had long been interested in the physiology of the human voice, and in 1840 had presented his "Mémoire sur la voix humaine" to the French Institute. What he saw now was interesting to him as a physiological phenomenon, and as such he described it in 1855 in "Observations on the Human Voice", com-

municated to the Royal Society of London by William Sharpey, the physiologist. Garcia wrote : "The pages which follow are intended to describe some observations made on the interior of the larynx during the act of singing. The method which I have adopted is very simple. It consists in placing a little mirror, fixed on a long handle suitably bent, in the throat of the person experimented on, against the soft palate and uvula. The party ought to turn himself towards the sun, so that the luminous rays falling on the little mirror, may be reflected on the larynx. If the observer experiment on himself he ought, by means of a second mirror, to receive the rays of the sun, and direct them on the mirror which is placed against the uvula." The remainder of his communication is devoted to the conclusions he drew from what he saw in his own throat of the various laryngeal movements ; it gives an admirable account of the action of the vocal cords during inspiration, expiration and vocalization, and records some important observations on the production of sound in the larynx.

How was it, then, that Garcia, the singing-teacher, and not Babington, Liston, Avery or any of the other physicians or surgeons, has been recognized as the first successful laryngoscopist ? It was, first, because Garcia laid emphasis, in his scientific paper, not so much on the actual instrument, but on what he had observed in the larynx—it was an idea, not an invention, he said. And secondly, it was because Garcia was himself a singer with a trained voice, accustomed to control his pharyngeal muscles. Segond said of him, in annotating his Royal Society communication in the "Gazette hebdomadaire de Médecine et de Chirurgie" of Paris (1855, Nov. 16, p. 816) : "M. Garcia has the faculty of supporting in the pharynx and at the isthmus of the fauces the prolonged contact of foreign bodies without provoking in him efforts at vomiting. . . . As for the ingenious procedure by which he was able to see the glottis in function, I hope indeed soon to be in a position to repeat it myself."

In the summer of 1857 Professor Ludwig Türck of Vienna, a well-known neurologist, began to use small long-handled mirrors for the examination of patients in hospital. In his treatise published in 1866 he stated : "Half through accident, without knowing of my predecessors, I came to the idea of using a small mirror for the investigation of laryngeal disease. First, as I was showing Professor Ludwig the internal laryngeal structures of a patient in my hospital division, I learned of Garcia's investigations." It

has been stated by others that Garcia's paper or the French comments upon it was known to Türck before he ever used a laryngoscopic mirror, but there seems no reason to doubt his own statement; he trusted, however, to the sunlight for illumination and by the autumn had put aside his mirrors as useless, saying, in the communication he published in April 1858, that he was "far from having any exaggerated hopes about the employment of the laryngeal mirror in practical medicine".

Professor Johann Nepomuk Czermak of Budapest, physician and physiologist, born and educated at Prague, in November 1857 borrowed Türck's mirrors "for physiological purposes" and, with the aid of artificial light, achieved success with them. In March 1858 he read an important paper on laryngoscopy before the Academy of Sciences of Vienna and—possibly in order to deprive Türck of any claim to priority—insisted on giving credit to Garcia for the invention of the laryngoscope. He pointed out that both Türck and Garcia had used sunlight, but he made use of lamp-light and advocated the use of a large perforated concave (ophthalmoscopic) mirror "for reflecting either the sun or artificial light". His first method of fixing the head-mirror appears to have been to hold its frame in the teeth, and it was his pupil Seemeleder in 1858 who attached it to a spectacle-frame; the familiar ball-and-socket joint for the mirror and the strap round the head were first suggested by the English pioneer laryngologist, T. J. Walker of Peterborough. Czermak also improved the laryngeal mirrors by having them made in a larger size and without the awkward hinge which they had at first. In a later publication he claimed—quite correctly—that but for his own invention of the reflecting mirror in association with the laryngoscopic mirror "laryngoscopy would have been a dead-born child". Less than a fortnight after his first publication Czermak gave a demonstration of the laryngoscope at a medical meeting in Vienna, at which Türck was present and claimed priority as the first to use the laryngoscope in the diagnosis of disease, which Czermak admitted. Czermak also turned his mirror upwards and, with the aid of a palate retractor, examined and described in July 1859 the nasopharyngeal cavity, the method being further developed and simplified by Friedrich Voltolini a year or two later (1861).

Both Czermak and Türck published pamphlets on the use of the laryngoscope, Czermak in 1859 and Türck in 1860, which were at once translated into French, and each went to Paris,

where they gave rival public demonstrations and lessons in the art of laryngoscopy. Czermak was particularly fortunate in possessing a large larynx and an insensitive pharynx, so that he was able to demonstrate laryngoscopy with great ease in his own throat to excited and enthusiastic audiences of doctors. He visited London in 1863, where he was the guest of James Yearsley at his house in Savile Row. Ill-feeling between Türck and Czermak increased so greatly that the former threatened a legal action in the High Court of Vienna. The two rivals made application for the Monthyon Prize of the Academy of Sciences of the Imperial Institute of France, which appointed a special commission to examine their claims; this commission, with Solomon-like wisdom, made no comment on the subject of priority, but gave them both honourable mention for their services to science in introducing the laryngoscope, and awarded each a money prize of 1200 francs.

The truth appears to be that while Manoel Garcia was the first successful laryngoscopist, and Ludwig Türck was the first to apply the laryngoscope to medicine (omitting Babington, Avery and the others as unsuccessful aspirants) or at least the first to describe the clinical appearance of laryngeal diseases, it was Johann Czermak who developed the laryngoscope into a practical surgical instrument of precision and popularized it with the medical profession—for at first it had been ridiculed as a “physiological plaything”.

It is pleasant to be able to record that Garcia, who died in London at the age of 102, lived to be recognized as the “Father of Laryngology”. Organized by Felix Semon, his 100th birthday was celebrated on March 17th, 1905, at a crowded international reception in the hall of the old Royal Medical and Chirurgical Society in Hanover Square, London. Delegates were present from universities, medical schools, colleges of music and scientific societies all over the world, including Russia, Sweden, Denmark, Germany, Holland, Belgium, France, Spain, Italy, Austria, Canada, the United States of America, South America and Japan. That morning, King Edward VII had conferred upon Garcia the Royal Victorian Order; at the meeting the Spanish Ambassador decorated him with the Royal Order of Alfonso XII; Professor Fraenkel of Berlin handed him the Great Gold Medal for Science, awarded by the German Emperor, which had been given previously to four scientists only; and a group of leading British and

American laryngologists presented Garcia with his portrait, which had been painted by John Singer Sargent. It is said by a friend of Garcia's that the old gentleman wondered what all the fuss was about: he had never meant to become the founder of a new medical speciality, and he protested that the mirror had only cost him six francs.

THE DEVELOPMENT OF LARYNGOLOGY

Controversy is an invaluable stimulus to the spread of medical knowledge, and the use of the laryngoscope was taken up quickly

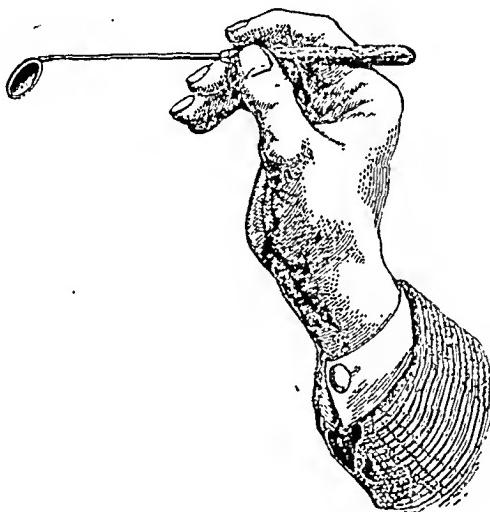


FIG. 40

The position of the hand and mirror, when the latter has been properly introduced for obtaining a view of the larynx

(From Morell Mackenzie's "Use of the Laryngoscope")

in the chief medical centres of the world. Morell Mackenzie was pursuing post-graduate studies in Vienna during the controversies between Türck and Czermak and was taught the use of the laryngoscope by Czermak in Budapest in 1859. He returned to London in 1860 an enthusiastic laryngologist, was awarded in 1863 the Jacksonian Prize of the Royal College of Surgeons for his three-volume "essay" "On the Pathology and Treatment of Diseases of the Larynx : the Diagnostic Indications to include the Appearance as seen in the Living Person", illustrated by some of the first water-colour drawings of the human larynx as it appears during life, and in the spring of 1863 founded his "Metropolitan

Free Dispensary for Diseases of the Throat and Loss of Voice ", which developed within a few years into the Throat Hospital, Golden Square, the first hospital devoted to diseases of the throat in the world, for long the Mecca of post-graduate instruction in laryngology.

Among Morell Mackenzie's earliest laryngologist colleagues in England were Prosser James (who published "Sore Throat, its Nature, Varieties and Treatment; including the Use of the Laryngoscope as an Aid to Diagnosis" in 1861), G. D. Gibbs (whose "On the Laryngoscope", published in 1861, was a translation of Czermak's treatise), James Yearsley the otologist (who had published his book on "Throat Ailments" in 1842, and published his "Introduction to the Art of Laryngoscopy" in 1862), T. J. Walker of Peterborough (who published "The Laryngoscope and its Clinical Application" in 1864), and George Johnson (who published "Lectures on the Laryngoscope" in 1865).

Apparently the first case of removal of a laryngeal polyp by the aid of the laryngoscope was that of G. R. Lewin on July 20th, 1860. Von Bruns in 1862 gave himself the credit of the first such operation, but knew nothing then of Lewin's report; he removed a polyp from his brother's larynx by laryngeal forceps after long training of his throat. According to Morell Mackenzie, T. J. Walker of Peterborough, in 1861, was the first in England to remove a laryngeal growth; he used a modification of Gooch's double cannula, which he called an écraseur. In 1867, J. Solis Cohen of Philadelphia reported the removal of a laryngeal polyp. Laryngological literature soon abounded in reports of similar operations; by 1871 the number published reached 189, and in that year Mackenzie gave details of 100 cases of his own. In 1876 C. Fauvel of Paris (in his "Traité pratique des maladies du larynx") reported 300 cases treated by himself; he also gave a careful description of 37 cases of cancer of the larynx.

MORELL MACKENZIE

Sir Morell Mackenzie (1837-92) was born at Leytonstone, Essex, where his father was a general medical practitioner, and was educated at the London Hospital, qualifying in 1858. He spent a year of post-graduate study in Paris and another in Vienna and Budapest, took higher qualifications on his return to London, was appointed Medical Registrar to the London Hospital, and



FIG. 41
Manoel Garcia at the age of 100, from the portrait by John S. Sargent
(By courtesy of *Rhode Island School of Design*)



FIG. 42
Sir Morell Mackenzie (1837-92)

started private practice as a consulting physician in 1862. He did not become assistant physician to the London Hospital (in 1866) until after he had established the Throat Hospital in Golden Square and had published his first book, on the "Use of the Laryngoscope", a well-produced volume, illustrated by excellent woodcuts, giving a review of the history of the laryngoscope, and a description of the new instruments and methods of examination, with illustrative cases. In 1870 he published his epoch-making book "Growths in the Larynx", with reports and an analysis of 100 consecutive cases of his own. When it is remembered that cocaine was not discovered until 1880, it will be realized that Mackenzie had not only seen an enormous number of cases of diseases of the throat, but had acquired almost unbelievable dexterity in removing growths from the larynx by the forceps which he had designed. One of his most fundamental and valuable contributions to the technique of laryngology was that he altered the angle of all laryngeal probes, forceps and other instruments from the wide curve of the German instruments to the right angle which reaches more accurately directly into the larynx from the mouth. Mackenzie's greatest work for posterity was his two-volume textbook, "Diseases of the Throat and Nose", which remains to this day the basis of all British laryngological literature, called by Sir St. Clair Thomson "the laryngologist's Bible"; the first volume, dealing with the pharynx, larynx and trachea, was published in 1880, and the second volume, dealing with the nose and the oesophagus, in 1884. Immediately translated into German and into French, it was at once universally recognized throughout the world as a classical treatise, the standard textbook of laryngology. The two volumes not only covered the whole field of the specialty as it existed at the time of publication, but anticipated by their author's suggestions many advances that owed their inspiration to him; for example, it was Morell Mackenzie who originated the term "abductors" and "adductors" for the two sets of intrinsic muscles of the larynx.

In 1887 Mackenzie, with the assistance of Norris Wolfenden, founded the monthly "Journal of Laryngology", which, having added "Otology", is still the sole British journal exclusively concerned with the specialty of oto-laryngology. He also founded, in 1888, the first British society devoted to laryngology, the British Rhino-Laryngological Association, which flourished (having added otology in 1895) until 1907, when it amalgamated with the London

Laryngological Society (founded by Felix Semon in 1893) to become the Section of Laryngology of the Royal Society of Medicine.

Sir Morell Mackenzie, who was an asthmatic, died of influenzal pneumonia at the age of 54, his death having been accelerated by the unfortunate controversies which clouded his later years. Summoned to Berlin in 1887 to attend the Crown Prince Frederick (later the German Emperor Frederick III), who was believed by his German medical attendants (on rather inadequate evidence) to be suffering from cancer of the larynx, Mackenzie, in a dramatic, eleventh-hour consultation, refused to agree to the operation which had been arranged until biopsy had been performed and a microscopic examination of the specimen carried out. Three successive specimens examined by the eminent pathologist Virchow proved to be negative. In his insistence on biopsy before a radical operation Mackenzie was on sure ground, but he relied too implicitly on the negative reports (for none of the specimens was really ample), though he never denied that the disease might be cancer—he gave a verdict of “not proven”. In a few months it became evident that the royal patient did indeed have cancer of the larynx, tracheotomy was performed as a palliative, and he died after having reigned as Emperor for ninety-nine days only. His premature death had an influence on the history of Europe, for if he had lived—and his father lived to be 90—he would undoubtedly have built up a liberal instead of a reactionary Germany, and two great wars with all their evil consequences for the world might well have been avoided. After the Emperor’s death Mackenzie was violently attacked both in Germany and in England as responsible for it; the German doctors and pro-Bismarck newspapers accused him of malpraxis and of bad faith in making his diagnosis, blaming the Empress Frederick and even Queen Victoria for influencing him to make his diagnosis a negative one. He replied to the attacks in an angry and ill-advised book, “The Fatal Illness of Frederick the Noble”, of which 100,000 copies were sold in a fortnight, but it was received with a storm of unfavourable criticism, especially from the medical profession in England; the tone of Mackenzie’s book was deplored, and his vehement personal attacks on his German colleagues in the case were considered highly unprofessional and unethical. He was censured by the Royal College of Surgeons and the British Medical Association, and resigned

from the Royal College of Physicians. Nevertheless, it should never be forgotten that Morell Mackenzie was the leading pioneer of British laryngology, the protagonist of the scientific study of disease of the throat among English-speaking doctors. As his biographer wrote : " Time is proving the soundness of Mackenzie's many fundamental contributions to laryngology, and it is beginning to be recognized that the art and science of medicine owes more to him than has been realized in the past ".

SEMON AND OTHERS

Morell Mackenzie's successor as the leading English laryngologist was of German birth, Sir Felix Semon (1849–1921). Semon came to London in 1875 as a young and unknown foreigner with an introduction to Mackenzie, who received him with marked kindness and eventually placed him on the staff of the Throat Hospital, Golden Square ; later, Semon was appointed in charge of the throat department at St. Thomas's Hospital in 1882, the first laryngologist to be appointed to a general hospital. An industrious worker, he translated Mackenzie's great textbook into German, showed that in progressive organic lesions the nerves supplying the abductor muscles of the larynx were affected before those of the adductors—a statement subsequently known as " Semon's law ", was one of the first to emphasize (in 1906) the supreme importance of vocal rest in the treatment of tuberculosis of the larynx, and with the aid of the surgical skill of Sir Henry Butlin (1843–1912), a general surgeon interested in diseases of the throat, developed the modern operation of laryngo-fissure for early cancer of the larynx. Semon did much to enhance the status of laryngology in England before he retired from active practice in 1911 at the zenith of his career, having been the recipient of many well-deserved honours at home and abroad. His memory is perpetuated in the Semon Lectureship in Laryngology of the University of London, generally considered the blue riband of British—and, indeed, of European—laryngology. Semon unfortunately made the mistake of spending his retirement in writing his autobiography, which when published (in 1926) after his death gave a rather surprising and unattractive picture of his character : he described a colleague as a " sly competitor ", while he himself was the champion of " honest specialism " ; he boasted of holding " the world's record for laryngeal cancer ",

80 per cent. of "lasting cures" (*i.e.* patients who survived for a year, including those diagnosed by him but operated upon by others); he gave lengthy and detailed lists of his distinguished patients (including Queen Victoria and King Edward VII) and of his prowess on the Scottish moors, and he attacked the character of Morell Mackenzie, to whom he owed almost everything, with a good deal of vindictiveness.

Lennox Browne (1841–1902), who founded the Central London Throat Hospital (now the Royal National Throat, Nose and Ear Hospital, the leading post-graduate teaching institution of otolaryngology in Britain) in 1874, was educated at St. George's Hospital and at Edinburgh, where he took the F.R.C.S.Ed. He was private assistant to Morell Mackenzie from 1865 to 1873, but Mackenzie did not place him on the staff of the Throat Hospital, Golden Square, for Lennox Browne, though brilliantly clever, had the reputation of being somewhat unscrupulous. He was a skilled artist who exhibited regularly at the Royal Academy, and supplied the excellent illustrations for Mackenzie's "Growths in the Larynx" and other works. He was the author of "The Throat and Nose and their Diseases" (1875), a popular textbook which went into five editions, and of "Voice, Speech and Song" (with Emil Behnke), which went into as many as twenty-one editions. Lennox Browne was a remarkable personality, with exceptional dialectic powers, but essentially combative and intolerant of opposition.

In Scotland the pioneer of laryngology was Peter McBride (1854–1946), who graduated at Edinburgh in 1876 and after post-graduate study in Vienna was appointed surgeon to the Eye and Ear Infirmary in Cambridge Street—the aural clinic added by J. Kirk Duncanson, "the oculo-auro-accoucheur", in 1872. McBride lectured on diseases of the ear, nose and throat in the extra-mural medical school, and in 1883 a department of one small room, in which patients were seen twice a week, was allotted to the specialty in the Edinburgh Royal Infirmary, McBride being placed in charge. In 1897 he was appointed lecturer to Edinburgh University on diseases of the ear, nose and throat; he was the author of a textbook on diseases of the throat, nose and ear (1891) and translated Gottstein's "Diseases of the Larynx"; and in his years of retirement he wrote books on philosophy and psychology. McBride was an excellent teacher, clear and concise, and it was due to him that in Edinburgh, unlike other centres, otology and laryngology were studied and practised as a united subject from the first.

James Patterson Cassels (1838-84) was the pioneer of modern oto-laryngology in Glasgow, though Donald Dewar (d. 1873) was apparently the earliest aurist in that city. John Macintyre (1857-1928) was an early laryngologist in Glasgow ; he was greatly interested in the application of electricity to medicine, was one of the earliest to use X-rays in the examination of the nasal sinuses and also in radiotherapy, and introduced the metal filament lamp into practical application in the exploration of the air-passages. James Walker Downie (1856-1921) was appointed to the nose and throat department of the Western Infirmary, Glasgow, in 1888, but twenty-eight years were to elapse before he had wards for in-patients. In 1895 he became University lecturer on diseases of the nose and throat. In Aberdeen James Mackenzie Booth lectured on oto-laryngology in the nineties, but a special department in the Royal Infirmary was created only in 1909.

LARYNGOLOGY IN AMERICA

Laryngoscopy was introduced into the United States in 1858 by Ernst Krackowizer, formerly of Vienna, but it was Louis Elsberg of New York (in 1861) and J. Solis Cohen of Philadelphia (in 1866) who played the chief parts in developing the new specialty in America. Elsberg had not then visited Europe, but his attention had been attracted by the work of Czermak, who sent him his book, and Elsberg taught laryngoscopy in the University Medical School in New York, and described instruments for laryngeal examination and treatment in the "Transactions of the American Medical Association" in 1863. Horace Green, the early American pioneer, lived long enough to see his claims for intra-laryngeal medication justified, and is said (by Delavan) to have obtained a laryngoscope through Krackowizer, but did not take an active interest in the new developments of laryngology ; he died in 1866. J. Solis Cohen published the first American textbook on "Diseases of the Throat" in 1872, was the first to establish organized instruction in laryngology at the Jefferson Medical School, and performed the first laryngectomy in America. Clinton Wagner, who was a pupil of Morell Mackenzie's at Golden Square, returned to America in 1873, founded the Metropolitan Throat Hospital in New York, introducing Mackenzie's hospital pharmacopoeia, and also founded the New York Laryngological Society, the first society of its kind in the world, in the same year.

MODERN HISTORY

IN the nineteenth century the introduction of ether by Morton in 1846 and of chloroform by J. Y. Simpson in 1847, the discoveries in bacteriology by Pasteur in 1857-85, the work of Lister on antisepsis in 1865-77, the advances of Helmholtz in physics in 1847-94, the invention of the electric light by Edison in 1879, and the researches of Virchow in pathology in 1847-99, all had profound effects upon the development of oto-laryngology.

OTOLOGY

The advances in otology that followed the work of Yearsley, Toynbee and Wilde were carried out mainly by German general surgeons. Neither Wilde nor Toynbee ever contemplated opening the mastoid for the removal of bone disease, but only in the presence of symptoms immediately threatening the life of the patient. In contrast with their views, Sir Charles Ballance has pointed out, was the forcible and rational advocacy of the operation by Forget, a French surgeon of the same period, who related the case of a boy aged 14, with acute otitis, in whom he proposed operation but was not allowed to carry it out. Three years later Forget was at length allowed to operate ; he opened the antrum, passed a seton from the meatus into the antrum, and brought it out through the operation wound, so that the suppurating cavity drained both ways. A further operation was subsequently undertaken and a large sequestrum removed, after which recovery rapidly took place, with some residual hearing.

In 1861 Anton von Trötsch (1829-90) published an important paper in which he reported a case upon whom he had operated in 1858. A girl aged 16 had otorrhoea after scarlet fever, and three weeks after the attack showed tenderness, redness and swelling of the right mastoid. He made an incision behind the right ear-drum to the bone, and pus immediately filled the meatus, though none appeared in the wound. A few days later, as severe pain recurred, he explored the wound with a probe and put in a plug as deeply as possible. Pus then began to come away from the

wound, and the patient was much better. The wound was irrigated daily and gradual improvement took place, though the patient died a year and a half later from tuberculosis. Friedrich Bezold (1842–1908) in 1877 gave the first clear description of mastoiditis, but before that date several surgeons, among them Hermann Schwartze of Halle (1837–1900), published cases in which operation was performed for the relief of suppuration within the temporal bone.

In 1868 L. Jacoby, a general surgeon of Breslau, wrote: "When there is inflammation of the mastoid process with an abscess near the external wall . . . it is self-evident to those who understand the subject that we ought at once to intervene by making Wilde's incision or by boring or cutting through the softened mastoid cortex. From a passage in von Tröltsch's textbook, and from a letter that Schwartze wrote to me, I infer that they both entertain the conviction that before long the operation of perforation of the mastoid will be adopted as the treatment of specially obstinate middle-ear suppurations, even when no urgent symptom of retention of pus is present."

Nevertheless, in spite of the successes recorded at the hands of certain surgeons in Europe and America, the mastoid operation was still condemned by the leading surgeons of the day. It is to the scientific insight and work of Schwartze and his assistant Adolf Eysell that we are mainly indebted for the first systematic account of the operation as a scientific procedure to be performed on a definite plan and under definite conditions. At first Schwartze used a perforator or a trephine to open the mastoid antrum, but later discarded these and operated with chisel and hammer. The value of the operation was soon demonstrated, although it was found to be much less valuable in chronic than in acute cases. Otologists continued to operate according to Schwartze's recommendations, but the general surgeons with few exceptions displayed an almost complete inactivity until 1888–9, when Ernst Küster and Ernst von Bergmann read useful papers before the German Surgical Society. Küster pointed out that Schwartze apparently never penetrated beyond the mastoid antrum, and he recommended "to open up the bone freely so that it can readily be scrutinized, to clear away all disease and so fully to expose the source of suppuration that the pus is nowhere checked at its outflow". Von Bergmann in the course of his paper (on a case of temporo-sphenoidal abscess from chronic ear disease) characteristically

made serious reflections on the methods of otologists in treating middle-ear suppuration, and particularly condemned irrigation of the ear. Stacke replied vigorously to this criticism, pointed out that the resources of the otologist were not limited to irrigations, and emphasized the importance of efficient surgical treatment. The credit of having devised and carried out a deliberate plan of operation for throwing tympanum, attic and antrum into one cavity, in such a way as to permit a close scrutiny and systematic dressing of the entire surface, is due to Ludwig Stacke of Erfurt and to Emanuel Zaufal of Prague. Zaufal's important paper was published in 1894, but he had first written on the subject in 1890. Stacke's book, "On the Operative Exposure of the Middle-Ear Cavities", was published in 1897, though he had already written on the subject in 1889. Stacke worked towards the antrum from the attic and Zaufal from the antrum towards the attic—so that the operation commonly referred to as Stacke's should in reality be termed Zaufal's.

"Suppuration in the temporal bone", as Ballance wrote, "does not differ from suppuration in other bones, and it is only natural that progress in its treatment should have been in part the work of those in practice as general surgeons and in part the work of such aural surgeons who, though devoting themselves to special practice, are inspired with the spirit of surgery." The value of the mastoid operation was but slowly recognized in England, and Sir William Dalby (1840–1919), the leading otologist of his day and founder of the Otological Society of the United Kingdom in 1900, never performed the mastoid operation at all, though in his writings he urged that it should be done. Like contemporary surgeons, his age and training were against him—they were the wrong age to absorb and practise the new Listerian doctrines. Dalby was educated at Cambridge and St. George's Hospital, became assistant and successor to James Hinton in Savile Row, and opened the aural department at St. George's Hospital in 1872. He did good work in advocating lip-reading for the deaf, and otherwise led the well-rounded social life of a Victorian sportsman.

Progress was bound up with earlier diagnosis and fuller knowledge of the anatomy of the temporal bone, and in England Charles Heath had called attention in 1904 to the importance of early operation and of more conservative measures. The work of Arthur Cheatle (1867–1929) of King's College Hospital, a charming personality, with somewhat inflexible opinions, was outstand-



FIG. 43
Sir William Dalby (1840-1919)



FIG. 44
Sir Felix Semon (1849-1921)



FIG. 45
Sir St. Clair Thomson (1859-1943)



FIG. 46
Adam Politzer (1835-1920)

ing. Cheatle made an extensive series of dissections of the temporal bone and paid special attention to the different types of pneumatization of the mastoid process. He considered the different types of mastoid as merely anatomical varieties, the two main types being the cellular and the acellular. Cheatle showed the latter to be a normal development and not, as previously believed, produced by the action of former suppuration. In the history of otology the name of Sir William MacEwen (1848-1924) of Glasgow must not be forgotten. Not an otologist, but a general surgeon of autocratic demeanour and more than a touch of genius, he was a pioneer of intracranial surgery, the author of "Pyogenic Diseases of the Brain" (1893), and the results of his operations for brain abscess have never yet been surpassed.

POLITZER

Every otologist owes an immense debt of gratitude to Adam Politzer (1835-1920), who taught otology in Vienna to several generations of post-graduate students. He was born at Alberti, in Hungary, and graduated at Vienna in 1859. He spent the next two years studying in Germany, England and France the anatomy, histology and physiology of the ear, under Kölliker, Heinrich Müller, Helmholtz, Toynbee (Politzer once said that "England could be proud to be the corner-stone of modern scientific otology"), Claude Bernard and Ménière, and on his return to Vienna in 1861 was appointed the first "dozent" in otology at the University; in 1870 he was promoted to be the first Professor of Otology. In 1873 the first university aural clinic was created, with two directors, Politzer and Josef Gruber; each had one room with ten beds, Politzer the female patients, Gruber the male patients, and this one room was ward, out-patient department, operating theatre and lecture room; such were the conditions under which the foundations of modern otology were laid. In addition, as otologist to the municipality of Vienna, Politzer had access to a vast amount of clinical and post-mortem material. In a few years the patients attending his clinic numbered from 12,000 to 15,000 each year, over 7000 foreign doctors attended his clinic for instruction—he could teach with equal fluency in German, English, French and Italian, and he published over one hundred original papers, as well as his famous Otoscopic Atlas containing 14 plates and 392 original pictures. His classical textbook on

diseases of the ear, "Lehrbuch der Ohrenheilkunde" (1878), went through many editions, was translated into English, and remained the standard textbook of otology for many years.

Politzer's main subjects of instruction were the anatomy and pathology of the ear, and he carried out important researches on cholesteatoma, otosclerosis and catarrhal exudative otitis media, labyrinthitis and deaf-mutism. His best-known contribution to clinical otology is his inflation of the middle ear by "politzerization", but he contributed to knowledge in every department of otology, and especially in the surgical treatment of endocranial complications of aural disease. Politzer retired in 1907 and spent his leisure in writing his great two-volume history of otology—a rich quarry in which every other historian of otology must dig—entitled "Geschichte der Ohrenheilkunde", and the first volume was published in 1907, the second in 1913. This grand old man of otology lived to the ripe age of 85, his later years somewhat disturbed by the war of 1914–18, but his popularity and his influence remained undiminished, and he retained to the end his keen interest in otology. That Politzer was no narrow specialist is evident from his remark that the essence of medicine could be summed up in the words, "Everything is connected with everything".

LARYNGOLOGY

In Victorian days the diagnosis between simple chronic laryngitis, syphilis, tuberculosis of the larynx, and malignant disease was always difficult and sometimes impossible, even for an experienced laryngologist. Koch did not discover the tubercle bacillus until 1882, Röntgen discovered X-rays in 1895, and Wassermann introduced his test for syphilis in 1906, so that the mid-Victorian laryngologist was obliged to rely solely upon his clinical acumen and experience. In the eighties, although laryngo-fissure and laryngectomy were being performed for cancer of the larynx, the results were uniformly bad; the cases were seldom seen early, at operation the growths were incompletely removed, patients were mistakenly given very deep anaesthesia followed by opiates, and pneumonia frequently developed after operation. The usually successful operations of today are due not only to earlier diagnosis and improved operative technique, but to advances in anaesthesia and after-treatment.

The teaching of laryngology in Vienna was begun by Türck and

Semeleder in 1861, and the former was appointed Professor of Laryngology in the university in 1864. Störk, von Schrötter and von Kristelli, disciples of Türck, carried on the work, and in 1870 a university laryngological clinic was instituted, with von Schrötter as chief. In the nineties rhinology was incorporated, and in 1899 Chiari became the head of the clinic, which was now called the university clinic for laryngology and rhinology ; under him the specialty passed more and more from being a medical to a surgical one. In 1919 the university Chairs of Laryngology and Otology were combined and Hajek was appointed head of the clinic ; under his direction the post-graduate teaching of rhinology and laryngology in Vienna became as world-famous as that of otology had already become. Markus Hajek (1862–1941) was, like Politzer, Hungarian by birth, and educated at Vienna. His early work was concerned with the anatomy of the nasal sinuses, to the surgery of which, and especially that of the ethmoid, he made important contributions, but he also wrote on laryngological subjects, such as the histology of the vocal cords. Hajek published in 1899 a valuable two-volume textbook on diseases of the nose and nasal sinuses, and gained a world-wide reputation as a teacher. He died in London in his 80th year, having left Vienna when it was invaded by the Nazis.

J. E. Moure (1855–1941), the leading laryngologist of France, was one of the pioneers in transforming laryngology from a medical to a surgical specialty. When the first professorship of oto-laryngology in a French university was established at Bordeaux he was appointed to the Chair. In 1880 he founded the “*Revue de Laryngologie*”, at first as a monthly and later as a weekly journal, in the editorship of which he was succeeded by his son-in-law, Georges Portmann. In 1902 he described the operation of lateral rhinotomy (Moure’s operation) as a route of approach to malignant disease of the nasal sinuses ; and he was also ardent in establishing the operation of laryngo-fissure for early cancer of the larynx.

Other notable pioneers of oto-laryngology in France were Lermoyez, Sebileau, Luc, Georges Laurens, Castex and Hautant of Paris ; Lannois and Chavanne of Lyons, Mouret of Montpellier, Escat of Toulouse, Bonain of Brest, and Molinié of Marseilles.

AMERICAN OTO-LARYNGOLOGY

As in other countries, in the United States special hospitals for the eye and ear preceded hospitals and special departments for the

throat. New London (Connecticut) had an eye dispensary as early as 1817; the New York Eye Infirmary, founded by Edward Delafield in 1820, added diseases of the ear in 1822; Philadelphia Institution for Diseases of the Eye and Ear was founded in 1822, the Massachusetts Eye and Ear Infirmary in 1824, the Baltimore Eye and Ear Institute in 1840, the Chicago (afterwards Illinois) Eye and Ear Infirmary in 1858, and the New Orleans Touro Infirmary (for the eye, ear and throat) in 1876. In America, Louis Elsberg had begun to teach laryngology in 1861, and in 1868 he became Professor of Diseases of the Throat in the University of the City of New York. As early as 1875 the teaching of laryngology was included in the curriculum of the Harvard Medical School and in the College of Physicians and Surgeons of New York. In the New York Eye and Ear Infirmary a separate throat department was instituted in 1873, and in 1875 a department for diseases of the throat was set up at the New York Dispensary. In addition to Horace Green, Louis Elsberg, Solis Cohen and others already mentioned, American pioneers in oto-laryngology include Lawrence Turnbull of Philadelphia (1821-1900), the first to perform the mastoid operation in America, and Ephraim Cutter, Roosa, Agnew, Lefferts, Knight, Nolan Mackenzie, Asch, Bosworth, C. G. Coakley, Harmon Smith, Jonathan Wright, as well as D. Bryson Delavan (1850-1942), who died in his 93rd year, the highly respected doyen of the specialty; Clarence Blake of Boston, C. H. Burnett and Chevalier Jackson of Philadelphia, Arthur de Roaldes of New Orleans, Adolph Barkan of San Francisco, Wells P. Eagleton of Newark, N.J., Theobald of Baltimore, J. M. Ingersoll of Cleveland, R. B. Canfield of Ann Arbor, W. L. Ballenger and G. E. Shambaugh of Chicago. In Canada notable figures are Herbert S. Birkett (1864-1942) of Montreal, who became Professor of Oto-Laryngology at McGill University in 1894, and the veteran Perry Goldsmith of Toronto.

No doubt because their comparative isolation induced the specialists to come together, otological and laryngological societies were founded in America before any such societies in England or on the continent of Europe. The American Ophthalmological and Otological Society was founded in 1864, chiefly from among specialists in New York, Boston and Philadelphia, and in 1868 the otologists withdrew to form the American Otological Society. The New York Laryngological Society was founded, as has been noted, in 1873; it merged with the Section on Laryngology of

the New York Academy of Medicine in 1885. The American Laryngological Society was founded in 1879. The American Laryngological, Rhinological and Otological Society was founded in New York in 1895, to reach a larger group of specialists, who qualify for membership by submitting theses, and the American Academy of Ophthalmology and Oto-Laryngology began as a western group in Kansas City in 1896, but its requirement for membership of certification by the respective examining boards has brought it the largest nation-wide membership. The American Medical Association authorized a joint Section of Ophthalmology and Oto-Laryngology in 1878, and it first met at Atlanta in 1879; a Section of Otology, Rhinology and Laryngology first received independent recognition in 1888.

The first special journal was the "Archives of Ophthalmology and Oto-Laryngology", founded by Hermann Knapp of New York in 1869, but he dropped oto-laryngology after 1880; the short-lived "American Archives of Laryngology" was issued from 1880 to 1884 in New York, under the direction of Louis Elsberg and others. The quarterly "Annals of Ophthalmology and Oto-laryngology" was founded by J. P. Parker of St. Louis in 1892; in 1896 he started a separate ophthalmological journal, while H. W. Loeb continued the quarterly "Annals of Otology, Rhinology and Laryngology", at present edited by A. W. Proetz. "The Laryngoscope" was founded in 1896 in St. Louis by Max A. Goldstein, and edited since his death in 1941 by T. E. Walsh. The present "Archives of Otolaryngology" was established in Chicago in 1925 as one of the special journals of the American Medical Association, with George E. Shambaugh senr. as chief editor, succeeded after a few years by George M. Coates.

BRITISH OTO-LARYNGOLOGY

Aural departments in the general hospitals in Britain had been placed in the hands of specialists long before throat departments; the first was Joseph Toynbee, who was appointed to St. Mary's Hospital in 1851, and Peter Allen (who had been assistant surgeon to James Yearsley at the Metropolitan Ear, Nose and Throat Hospital) succeeded him on his death in 1866. Sir William Dalby, as has been noted, was appointed to St. George's Hospital in 1872, Laidlaw Purvis (uncle of Sir James Dundas-Grant) to Guy's Hospital in 1874, and Urban Pritchard to King's College Hospital

in 1876. In the seventies the hospitals and the teaching schools regarded laryngology with indifference : it had no standing in the general hospitals, and diseases of the throat were in the charge of the junior physicians on the staff. Thus Hughlings Jackson, "the Socrates of neurology", was then in charge of the Throat Department at the London Hospital, Lauder Brunton the cardiologist at St. Bartholomew's Hospital, and W. S. Greenfield, a physician who became Professor of Pathology at Edinburgh University, at St. Thomas's Hospital ; Felix Semon, who was a physician-laryngologist, persuaded the board of St. Thomas's Hospital to appoint him in place of Greenfield in 1882, the first laryngologist to be appointed to a general hospital.

In London, as has already been noted, the first special hospital was Moorfields, for diseases of the eye and ear, founded by John Cunningham Saunders in 1805. John Harrison Curtis founded the ear dispensary in 1816 that became the Royal Ear Hospital in 1845 ; it amalgamated with University College Hospital in 1919. The Metropolitan Ear, Nose and Throat Hospital, founded by James Yearsley in 1838, was practically re-founded in Fitzroy Square by Hemington Pegler and Frederick Spicer in 1897. The Throat Hospital, Golden Square, was founded (as already noted) by Morell Mackenzie in 1863 ; it amalgamated with the London Throat Hospital (founded by Edward Law and McNeill Whistler in 1887) in 1914, and with the Central London Throat and Ear Hospital, Gray's Inn Road (founded by Lennox Browne in 1874), in 1939 to form the Royal National Throat, Nose and Ear Hospital.

The Shrewsbury Eye and Ear Hospital was founded in 1818, the Leeds Eye and Ear Dispensary in 1829—it amalgamated with the Leeds Royal Infirmary in 1868, the Liverpool Eye and Ear Institute (now the Eye, Ear and Throat Infirmary, Myrtle Street) in 1841, the Birmingham Ear (and Throat) Hospital in 1844, the Manchester Ear Hospital in 1855, the Bradford Eye and Ear Infirmary in 1857, the Newcastle-on-Tyne Ear and Throat Hospital in 1877, and the Brighton Ear and Throat Hospital in 1878. The Edinburgh Eye Infirmary, Cambridge Street, established in 1834, added ear in 1872 and throat diseases in 1883 ; the Edinburgh Royal Infirmary opened its ear and throat department in 1883 ; in Glasgow a short-lived ear dispensary was opened in 1858, Cassels in 1872 founded an ear dispensary which became the Glasgow Ear Hospital in 1880, and the Glasgow Western Infirmary opened its aural department under Thomas Barr in 1877 ; Aberdeen Royal

Infirmary instituted a department for diseases of the ear, nose and throat under Henry Peterkin in 1909. In Dublin, as has been noted, St. Mark's Eye and Ear Infirmary, founded by Wilde in 1844, amalgamated with the Royal Victoria Eye and Ear Hospital in 1896; and in Belfast the Eye and Ear Dispensary began in 1844. In Canada, L. J. A. Simard was appointed Professor of Otology at Laval University, Montreal, in 1862, and a lectureship in otology was instituted at McGill University in 1883. In Australia the first ear and throat clinic was established in 1886 in Sydney Hospital, though in Melbourne in 1863 Andrew Lexton Gray had founded a private hospital for eye and ear diseases; in New Zealand the first ear dispensary was opened in Dunedin in 1884.

The first British society devoted to laryngology, the British Rhino-Laryngological Association, was founded by Morell Mackenzie in November 1888, and added otology in 1895; Felix Semon founded the London Laryngological Society in 1893; the two societies amalgamated to become the Section of Laryngology of the Royal Society of Medicine in 1907. Sir William Dalby founded the Otological Society of the United Kingdom in 1900, and it became the Section of Otology of the Royal Society of Medicine in 1907. The Scottish Otological and Laryngological Society was founded in 1910. The British Medical Association at its Annual Meeting in 1887 for the first time admitted a separate Sub-Section of Laryngology, and in 1888 granted laryngology the dignity of a full Section. In 1881, at the International Medical Congress in London, laryngology had been allotted a Sub-Section, and this became a full Section at the International Medical Congress in Copenhagen in 1884. The only British journal devoted to oto-laryngology, the "Journal of Laryngology and Otology", was founded by Morell Mackenzie and Norris Wolfenden in 1887; it is now edited by Walter Howarth. Felix Semon's comprehensive index of laryngological literature, the "Centralblatt für Laryngologie", was founded in 1884, revived after the war of 1914-18, but did not survive the war of 1939-45.

In recent years oto-laryngology has reflected the vast advances in all fields of general medicine and surgery, including neurology, ophthalmology, bacteriology, pathology, biochemistry, diagnostic and therapeutic radiology, and thoracic surgery. In Britain oto-laryngology has been well and strongly represented, and much useful original work has been accomplished, especially by Milligan of Manchester, J. S. Fraser of Edinburgh, Albert Gray of Glasgow,

A. R. Tweedie of Nottingham, Sir Charles Ballance and G. J. Jenkins of London, in otology; Herbert Tilley of London, Patrick Watson-Williams of Bristol, and Logan Turner of Edinburgh, in rhinology; and Brown Kelly of Glasgow, Paterson of Cardiff, Dundas-Grant, Dan McKenzie and St. Clair Thomson of London, in laryngology.

Sir William Milligan (1864–1929) was born and educated at Aberdeen, but after studying at Vienna and Göttingen migrated to Manchester, where he was appointed aural surgeon to the Manchester Royal Infirmary. His surgery was founded on a sound knowledge of pathology, and he introduced scientific otology and new methods to the north of England. Incisive in speech and definite in his opinions, a brilliant operator with a masterly technique, he was a pioneer in the use of radium in cancer of the larynx, and was the author of an excellent textbook, "Diseases of the Ear" (1911), in association with Wyatt Wingrave, the pathologist. John Smith Fraser (1874–1936), educated at Edinburgh and Vienna, was both a successful clinician and an earnest scientific investigator; of particular note was his work on congenital deaf-mutism, on otosclerosis, and on the pathways of infection from the ear to the brain and meninges. He was a popular teacher and a candid critic in debate.

Albert Alexander Gray (1869–1936), a Quaker, educated at Glasgow and Munich, carried out many researches on the ear, particularly on otosclerosis. He was the author of books on the labyrinth of animals, on otosclerosis, on the mechanism of the cochlea (with G. Wilkinson), and his *magnum opus*, "An Atlas of Otology", all of them beautifully illustrated. Modest and unaffected, he was much beloved by his colleagues. Alexander Robert Tweedie (1871–1936), educated at St. Bartholomew's and Golden Square, was a man of vigour and initiative who served in the South African War and commanded a hospital in Egypt and Palestine in the war of 1914–18. He was appointed in 1911 to the surgical staff of Nottingham General Hospital and created the ear, nose and throat department. Particularly interested in problems of the labyrinth, to which he made many contributions, he was also devoted to the welfare of the deaf. Founder of the Collegium Oto-Rhino-Laryngologicum along with Professor Benjamins of Gröningen, he visited every otological clinic of importance on the Continent.

Sir Charles Ballance (1856–1936) was surgeon to St. Thomas's

Hospital and the Hospital for Nervous Diseases, Queen Square. He shared with MacEwen of Glasgow the credit of placing the treatment of intracranial complications of middle-ear suppuration on a proper surgical basis, and he was the second (after Arbuthnot Lane) to operate for lateral sinus thrombosis. He also did valuable work with Arthur Duel on the surgical treatment of facial palsy. The two noble volumes of his "Surgery of the Temporal Bone" are a store of historical learning, clinical wisdom and magnificent illustrations. He is remembered for his kindness, his generosity and his large view. G. J. Jenkins (1874–1939) was an Australian, educated at Edinburgh, who taught anatomy and then otology at King's College Hospital, London. He was a pioneer of the surgical treatment of meningitis, and in 1913 published his results after fenestration of the labyrinth; he believed, however, that otosclerosis was a change affecting the whole capsule of the labyrinth, and that deafness in otosclerosis was due to a change in the labyrinthine fluids, not to obstruction of the oval window, which he regarded as a secondary effect. He was generous in his recognition of the achievements of others, and his pioneer work has been acknowledged by Holmgren and by Sourdille.

Herbert Tilley (1867–1941) was educated at University College Hospital, to which he was afterwards appointed the first ear, nose and throat surgeon. He was one of the pioneers of the surgery of the nasal sinuses and contributed to the study of their pathology, made useful modifications to the modern tonsil operation, and wrote a standard textbook on diseases of the nose and throat. A kindly teacher, he attracted many keen workers to his clinic. Patrick Watson-Williams (1860–1938) was educated at Bristol, became Physician to the Royal Infirmary there, and took charge of its newly created throat department in 1906. In 1892 he had already published a book on diseases of the upper respiratory tract, and he was one of the leaders in Britain of the systematic study of the nasal sinuses, emphasizing the relation between chronic nasal sinus infection and general diseases, especially in mental disorders. He is remembered as a genial and wise rhinologist.

Arthur Logan Turner (1865–1939) was the second son of the famous Professor of Anatomy and Principal of Edinburgh University, Sir William Turner. Educated at Edinburgh, he was connected with the Edinburgh Royal Infirmary from his youth until the end of his life, and wrote its history as well as the history of

his university. He was the editor of a very popular textbook for students on diseases of the throat, nose and ear, was editor for many years of the "Journal of Laryngology and Otology", and was a successful teacher of oto-laryngology and stimulator of research in that subject. His own contributions were mainly on the nasal sinuses and on intracranial complications connected with them. He was a man of kindly disposition and unassuming manner, who held the affection of his pupils and his colleagues.

Adam Brown Kelly (1865–1941) graduated at Glasgow in 1888, published no book, but was the author of many original papers. Along with D. R. Paterson he described in 1919 ("Journ. Laryng. and Otol.", vol. xxxiv, p. 285) that form of dysphagia in women associated with anaemia and a glossy pharyngeal mucosa, called afterwards in America the Plummer-Vinson syndrome. He was also one of the first to write on congenital shortening of the oesophagus, and he did useful work on cardiospasm. Shy and modest, he had a keen interest in scientific research. Donald Ross Paterson (1863–1939), educated at Edinburgh, began his career as a physician at Cardiff Royal Infirmary; on his initiative a department for diseases of the throat, nose and ear was instituted, of which he became the head. He studied under Killian at Freiburg and was a pioneer of endoscopy in Britain and (as already noted) collaborated with Brown Kelly in researches in dysphagia. Of a retiring nature, he was an archaeologist of note and wrote monographs on Celtic subjects.

Sir James Dundas-Grant (1854–1945) was educated at Edinburgh, began in practice in the East End of London, then took up oto-laryngology in 1886, when his knowledge of French and German proved useful to Lennox Browne, and he was appointed to the Central London Throat and Ear Hospital in 1889. He was an excellent teacher, with a retentive memory, and invented many instruments—his aural probe, mastoid probe and cold air douche for labyrinth tests being the best known. He was an enthusiastic musician, and was interested in everything and everybody. Dan McKenzie (1874–1936), after a brilliant academic career at Glasgow, was first in general practice in Lanarkshire, then came to London and eventually was appointed to the Central London Throat and Ear Hospital. Endowed with a mellifluous literary style, he wrote "The City of Din", "Aromatics and the Soul", "The Infancy of Medicine", and several romantic novels, as well as a comprehensive textbook on diseases of the ear, nose and

throat. He was the editor for several years of the "Journal of Laryngology and Otology", and was a pioneer in the use of diathermy in malignant disease of the throat. A good teacher, an excellent debater rather than orator, he was humorous, genial, tolerant.

Sir St. Clair Thomson (1859-1943), although born in Londonderry, had his family origins in Ardrishaig and was proud to proclaim himself a Scot. Educated at King's College, London, he qualified in 1881 and became house surgeon to Lister at King's College Hospital. He never tired of recalling his great master, who had a direct and abiding influence upon him and so upon the progress of laryngology, particularly in his minute attention to every detail of a case. Thomson's post-graduate training in laryngology and otology was received in Vienna, Paris and Lausanne, chiefly under Hajek, von Schrötter, Störk and Politzer, and after some experience of practice in Florence he returned to London as Physician to the Throat Hospital, Golden Square, and Surgeon to the Royal Ear Hospital, Dean Street. In 1901 he was appointed to the department of diseases of the nose and throat at his old hospital, King's College Hospital, to which he added lustre until his retirement in 1924 at the age of 65. The subjects chiefly associated with the name of St. Clair Thomson are cancer of the larynx and tuberculosis of the larynx. His technique in the operation of laryngo-fissure in early intrinsic cancer of the larynx has been followed all over the world, and the marked lessening in the mortality of the operation was directly due to his teaching. He held that if laryngo-fissure were carried out according to the correct technique it should be free from danger to life and should be followed by an adequate voice and lasting cure. In the treatment of tuberculosis of the larynx he followed Semon in his insistence on the importance of vocal rest and Grünwald in emphasizing the value of electric cauterization. His monumental textbook, "Diseases of the Nose and Throat", was first published in 1911, and successive editions followed until 1948. Sir St. Clair Thomson had a well-deserved reputation as an orator of wit and learning, with a penchant for quoting Shakespeare with peculiar aptness; he was fluent in several languages, and his easy friendliness made him *persona grata* in all oto-laryngological circles throughout Europe and America. Bombed out of his beautiful home in Wimpole Street he retired to Edinburgh, where he was knocked down by a motor-cyclist in January 1943.

ADVANCES IN OTOTOLOGY

The researches of Robert Bárány (1876–1936), Nobel prize-winner, formerly of Vienna and latterly of Upsala, clarified our knowledge of the vestibular apparatus, to which the work of Rudolph Magnus and his disciples at Utrecht has added. H. Neumann (1873–1939), successor to Politzer and Urbantschitsch in the Chair of Otology at Vienna, among other fundamental researches in otology, modernized the mastoid operation by his systematic evacuation of all the mastoid cell groups (following the teaching of Mouret of Montpellier) and influenced innumerable pupils. A dynamic personality, with ready wit, he was a notable figure at all otological meetings. Just as the "simple" or Schwartzé mastoid operation has become more radical, so has the "radical" mastoid operation become more conservative and is now less commonly performed. The introduction of sulphon-amides and antibiotics has completely changed the outlook in the treatment of acute otitis media and acute mastoiditis and has compelled the otologist to revise his indications for operation. The once-dreaded otogenic meningitis has become amenable to treatment, and the drastic operations formerly designed for its relief are obsolete; the antibiotics are likewise changing the prognosis and methods of treating brain abscess.

Surgery has given new hope in otosclerosis, for which in the past no medical treatment of any kind—drugs, glandular preparations, diets, vitamins—had ever succeeded in restoring the hearing; Bárány, in 1911, and G. J. Jenkins, in 1913, were pioneers in attempts to decompress the labyrinth; G. Holmgren of Stockholm in 1917 began the researches on the surgery of the labyrinth which came closer and closer to success and influenced Sourdille of Nantes (subsequently of Strasbourg) and others; Maurice Sourdille was the first to perform a successful fenestration operation for the relief of deafness in otosclerosis, but his operation was complicated and done in stages, and not until Julius Lempert of New York had first simplified and then elaborated the technique, did fenestration become practicable.

Facial paralysis is no longer merely left to chance to recover or not, nor is the nerve repaired by hypoglossal or glosso-pharyngeal nerve splicing, but, thanks to the work of Sir Charles Ballance and Arthur Duel, it is amenable to decompression of the facial nerve in its canal and, when necessary, filling the gap with a nerve

graft. Suppuration in the petrous tip of the temporal bone is treated by appropriate surgical operation or increasingly by the use of antibiotics. The study of vertigo, which dates back to Flourens and the description by Prosper Ménière in 1861, has been advanced by the recent researches of C. S. Hallpike and H. Cairns and others, and the condition is surgically treated either by the somewhat elaborate section of the vestibular nerve (Dandy, 1934) or by alcoholic or electrical destruction of the semicircular canals. Otology in relation to aviation, and especially our knowledge of aero-otitis (otitic barotrauma), owes much to the work of the R.A.F. Medical Service during the war of 1939-45.

HEARING TESTS AND HEARING AIDS

Tuning-fork tests for investigating hearing date back to Weber, Rinne and Schwabach in the nineteenth century, and have already been discussed. In recent years the most notable development has been the invention of the audiometer, an instrument which takes advantage of the possibilities of the use of electricity in the measurement of sounds. Stimulated by the invention of the telephone in 1876 by Alexander Graham Bell, A. Hartmann devised an electrical instrument for hearing tests, described as an "acoumeter". Similar instruments were produced by D. E. Hughes of London (1879) and Urbantschitsch of Vienna (1884), and in 1897 Seashore of Iowa produced the instrument from which L. W. Dean and C. C. Bunch developed the pitch-range audiometer with a full range of frequencies. The first practical audiometer of the thermionic-valve (vacuum tube) type was the I-A audiometer of the Western Electric Company of America in 1922, and E. P. Fowler, senr. and R. L. Wegel published the first "audiograms". The evaluation of the hearing in an individual case, however, demands not only testing by an audiometer in a sound-proof room by an experienced technician, but consideration of the history, otological examination, and voice and tuning-fork tests.

Hearing aids in the form of ear-trumpets and tubes go back at least 250 years, and are still useful, especially to elderly persons timid of the mechanics of an electrical aid. The first commercial electric hearing aid, of the micro-telephone type, was made in America in 1898 by the Dictagraph Company, but since the invention of the thermionic valve (vacuum tube) great advances have

been made, the modern hearing aid consisting essentially of a microphone, an amplifier and a receiver, and employing a high-tension battery and a low-tension battery. During the war of 1939-45 there was a rapid development of miniature radio valves, which lent themselves to incorporation in hearing aids; it has become usual to incorporate the transmitter in the amplifier unit, and most modern aids are of the "monopac" type, the batteries being also included in a small plastic case. The modern hearing aid can help many cases of "nerve" (perceptive) deafness as well as most cases of "middle-ear" (conductive) deafness, but a deaf person requires training in its use and also in lip-reading to get the full benefit it is capable of giving.

MODERN RHINOLOGY

In rhinology the oto-laryngologist is tending to become more conservative, as the physiology of the nasal sinuses begins to be better understood, especially the importance of the maintenance of drainage and of normal ciliary activity. The trend is to lay less emphasis on surgery and more on the rôle of allergy and the increasing use of antibiotics, though they have so far proved less successful with chronic than with acute nasal sinusitis; when surgical operation is indicated in sinusitis the tendency is for a radical and external operation to be performed rather than an intranasal operation. R. C. Lynch of New Orleans and Walter Howarth of London in 1921 independently devised an effective operation on the frontal and ethmoidal sinuses, from the orbit, without any deformity or ugly scar, which is widely employed. In the conservative treatment of nasal sinusitis a useful advance has been made by employing the so-called displacement method of A. W. Proetz (1931), by which any fluid can be introduced into the nasal sinuses with ease, provided the ostia are patent, loosening inspissated secretions and bringing about drainage of infected sinuses.

TONSILS AND ADENOIDS

The problem of tonsils and adenoids still gives rise to considerable discussion, though less among oto-laryngologists—who are at last more or less in agreement on this subject—than among general physicians and indeed the general public. On one point, however, all authorities are now agreed, and that is that if disease

is to be eradicated by tonsillectomy the tonsils must be removed completely. It is the general recognition of this principle that has brought about in the twentieth century a revolution in methods of operating upon the tonsils, for it is recognized that in complete tonsillectomy the lowermost limit of the tonsil must be enucleated in its capsule along with the general mass of the tonsil, because if a stump of tonsil be left lymphoid reproduction will usually begin from it again. When Whillis and Pybus in 1910 revolutionized guillotine tonsillectomy by employing the reverse method, pressing the tonsil outwards and into the aperture of the guillotine by pressure on the anterior pillar of the fauces with the finger, in their first series of 200 cases they made the modest claim that they were able to enucleate 42 per cent. of tonsils complete in their capsule in one piece ; in a later series of 100 cases they were able to claim 74 per cent. of cases enucleated complete in one piece. Greenfield Sluder of St. Louis in 1912 published a paper (originally read before the American Medical Association in 1910) claiming 99.6 per cent. of completely successful results in tonsillectomy by using a guillotine in a somewhat similar manner. Practice in this method no doubt has increased the percentage of complete results in skilful hands, but it is improbable that the average operator with the guillotine achieves anything near 100 per cent. of complete tonsillectomies. To achieve this desirable result G. E. Waugh in 1909 published his method of methodical, blunt dissection of the tonsils, which has since been modified in various details by Herbert Tilley and others, using dissecting forceps and snare, and tying off bleeding points ; by this method the pillars of the fauces are not damaged, and inhalation of blood-clot is avoided. The patient is placed on his back with a sandbag under his shoulders and his head is lowered and well extended on his neck ; the operator sits, with an adequate light, at the head of the table, and the patient is given a general anaesthetic. Alternatively, the operation can be performed under local anaesthesia, with the patient sitting up.

Diathermy, radium and X-rays have all been recommended in the treatment of unhealthy tonsils, but none of them are satisfactory methods ; with diathermy the danger of secondary haemorrhage is considerable, and in many cases the removal is incomplete. Radium and X-rays do cause fibrosis or even destroy the lymphoid tissue of the tonsils, but have no effect on the crypts and their infected contents. The application of radium,

for a brief period and under a radiologist's supervision, to shrivel adenoid remains has, however, proved effective.

RECENT WORK IN LARYNGOLOGY

As regards tuberculosis of the larynx, it must be remembered that it is never primary, and treatment must always be founded upon the conception that it is always secondary to tuberculosis of the lung; the most striking advance in the treatment of that disease is the realization that its cure can be effected in many cases by surgical means, such as artificial pneumothorax, adhesion section, phrenic avulsion, thoracoplasty. Hence the surgical treatment of the larynx itself, sometimes heroic, advocated by a former generation, has been abandoned, and methods directed to the lung are in the ascendant. At one time, a laryngeal lesion was considered to be a contra-indication to any form of collapse therapy or to paralysis of the diaphragm; opinion has now completely changed, and the presence of a lesion in the larynx is a definite indication for such measures.

Even after the invention of the laryngoscope, cancer of the larynx was looked upon as a rare disease, and as late as 1880 Störk of Vienna observed that cancer was rarely found limited to the larynx and most frequently invaded it from the mucous folds between the epiglottis and the tongue, or between the epiglottis and the oesophagus. Henry Butlin in 1883, however, stated that the vocal cords were the most common seat of the disease; but it was not until 1921 that Sir St. Clair Thomson proved, from an examination of fifty cases operated upon, that the most common site of intrinsic cancer of the larynx was the central portion or anterior half of the vocal cord, thus correcting the opinions of Semon and Virchow, upheld until that time, that growths in the posterior half of the larynx were more likely to be malignant. Krishaber in the eighties demonstrated that laryngeal cancer arising in the interior of the larynx is relatively benign in character and slow in growth, and that it invades the glands only at an advanced stage. It was Krishaber who suggested the classification of cancer of the larynx into the two groups, intrinsic and extrinsic; and Isambert suggested that subglottic cancer should be a third group.

The consideration of the treatment of cancer of the larynx today presents some difficulty amid the diverse views of the advocates and the critics of surgical operation, radium and X-rays. In

skilled hands the results of early intrinsic cancer of the larynx, with a growth limited to the membranous vocal cord, whether treated by irradiation or by surgical operation, are about the same. A rather more advanced case, with a growth on one vocal cord extending to the arytenoid or reaching the anterior commissure, but without fixation of the cord, is best treated by irradiation, as surgical treatment would entail removal of the whole larynx. In still more advanced, widespread cases, with fixation of the vocal cord or with an extensive subglottic growth, total laryngectomy is necessary, as in such cases irradiation has not so far proved sufficiently successful to be preferred. The main point at issue is, under what circumstances should radiotherapy be used for operable cancer of the larynx ; and the answer depends on the experience of the radiotherapist and of the surgeon. The patient who has undergone laryngectomy is today in a more fortunate position than formerly. Until comparatively recently all efforts were directed to producing an instrument with which the laryngectomized patient could talk, but gradually it was found that nearly all such patients could be made to talk without any artificial aid ; they could be trained to swallow air and with it to produce vibrations in the pharynx and an understandable oesophageal voice, without very much difficulty.

RADIOLOGY IN OTO-LARYNGOLOGY

X-rays, discovered by Wilhelm Konrad Röntgen (1845–1922) when Professor of Physics at Würzburg in 1895, were soon applied to oto-laryngology. In September 1896 Max Scheier addressed a medical society at Frankfurt on the value of X-rays in the diagnosis of diseases of the nose and throat ; in his plates the outlines of the nasal sinuses could scarcely be seen, but enough was shown to stimulate further endeavour, and Killian of Freiburg in 1903 and Coakley and E. Caldwell of New York in 1906 were pioneers in the radiological examination of the nasal sinuses. The technique of Coakley and Caldwell has, with few modifications, remained the 'standard up to the present time. Caldwell based his technique on the principle that standardized positions, not dependent upon patients' widely differing facial contours, are essential if a thorough knowledge of the normal, as opposed to the abnormal, appearances of the sinuses and mastoids is to be obtained. Recent work both in this country and abroad has extended the scope and improved the technique of radiological examination as applied to

oto-laryngology, and the results are accordingly of increased value. X-ray therapy, introduced by Perthes in 1903, has also steadily increased in value and in use. Its application to malignant disease, especially when affecting the larynx and pharynx, has in recent years given results comparable with, and in some types of disease better than, surgery. Radium was discovered by the Curies in 1898, and first applied to malignant disease by Danysz in 1903. In laryngology, Milligan of Manchester, Douglas Harmer of London and Delavan of New York were pioneers in the use of radium. Technical improvements in radiotherapy and the employment of greatly increased dosages by beam therapy, have improved the outlook in malignant disease of the nose and throat in recent years.

OESOPHAGOSCOPY AND BRONCHOSCOPY

Although P. Bozzini of Weimar in 1806, Fisher of Boston in 1824, Ségales of Paris in 1826, and John Avery of London about 1848, all devised primitive endoscopes, mainly for the direct examination of the urinary bladder, vagina or rectum, none of them appears to have achieved practical success with such instruments, and the pioneer of practical endoscopy must be looked upon as Desormeaux of Paris, in 1853. In his memoirs Desormeaux states frankly that he did not originate the idea of direct examination, but he devoted many years to the subject and to improving his instrument, which was designed as a urethroscope. Richard Cruise of Dublin (1865) has been mentioned as a pioneer of endoscopy but, although he increased the usefulness of Desormeaux's urethroscope by improving the illumination and pointed out that it could be employed for the examination not only of the bladder, rectum and uterus, but also of the auditory meatus, pharynx, larynx and, he hoped, the oesophagus and stomach, he did not in any way influence his successors. Kussmaul of Freiburg in 1868, using the urethroscope of Desormeaux, was the first to perform direct oesophagoscopy, employing a sword swallower in his demonstrations and using the sword-swallowing position; his pupil Müller showed that a rigid tube 13 mm. in diameter could be introduced safely into the normal oesophagus. Waldenburg of Berlin in 1868 employed a gum-elastic tube 8 cm. in length as an oesophagoscope and later designed a telescopic metal tube, which was also used by Störk of Vienna about 1871. Both Waldenburg and Störk, however, used the method of indirect

examination by the laryngeal mirror with their tubes. Morell Mackenzie designed, in 1880, a skeleton oesophageal tube, but used it likewise for indirect examination with a laryngeal mirror; Irwin Moore doubts, with some reason, whether this delicate

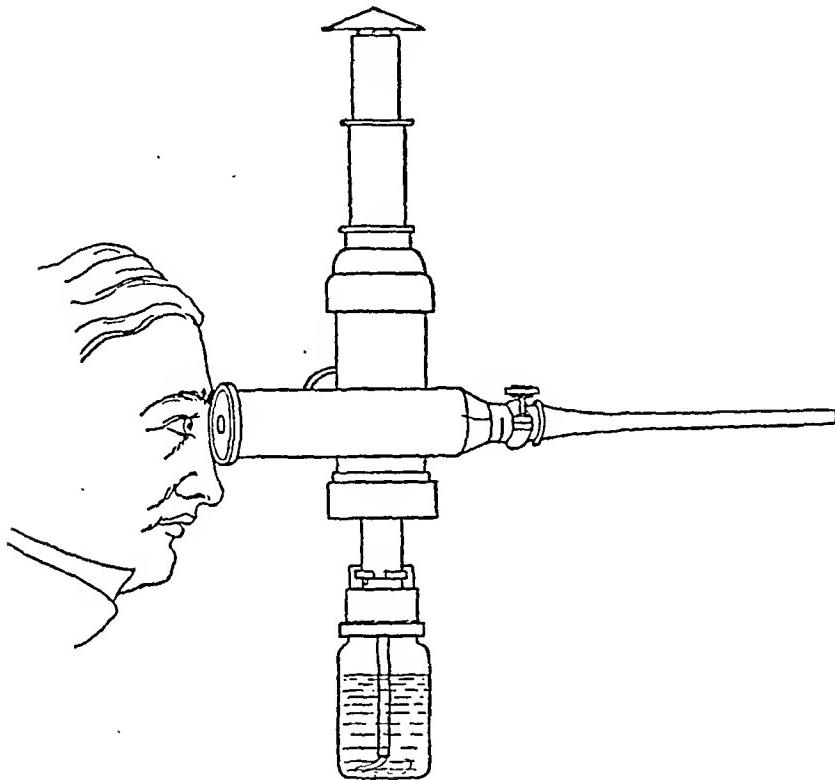


FIG. 47
Endoscope of Desormeaux
(“*Journal of Laryngology and Otology*”))

instrument was ever inserted beyond the lower sphincter orifice of the deep pharynx.

Von Mikulicz of Vienna, who was familiar with Kussmaul's experiments, in 1881 designed a practical oesophagoscope, a straight rigid tube with slanting distal end, illuminated by means of an interior platinum-wire, and his anatomical, physiological and pathological investigations on the oesophagus form the basis of our practical knowledge today of oesophagoscopy. Von Mikulicz's oesophagoscope was improved by Von Hacker in 1889, Gottstein of Breslau in 1891 fitted an extra tube to it for suction and employed cocaine for local anaesthesia before inserting it, while Rosenheim of Berlin in 1895 improved the method of illumination.

Up to this time laryngologists had been content to use the laryngoscopic mirror for indirect examination of the larynx, although Joseph P. O'Dwyer of New York, of intubation for diphtheria fame, devised a tube of large calibre and thin walls for the expulsion of foreign bodies from the trachea and bronchi; the tube was inserted into the larynx, the patient placed on his back and somewhat inverted, and the foreign body extruded by

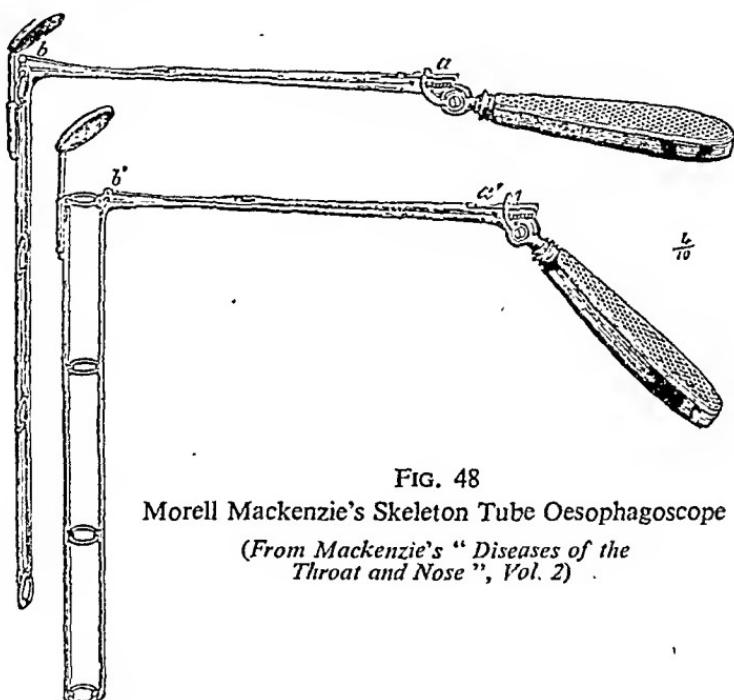


FIG. 48
Morell Mackenzie's Skeleton Tube Oesophagoscope
(From Mackenzie's "Diseases of the Throat and Nose", Vol. 2)

coughing (according to Bryson Delavan). On April 23rd, 1895, Kirstein of Berlin saw for the first time the interior of the larynx by direct examination, employing a flat spatula and Caspar's prismatic incandescent lamp (used in oesophagoscopy by Rosenheim), with the patient's head extended and tongue and epiglottis depressed. Gustav Killian of Freiburg, called the "Father of Bronchoscopy", impressed by the work of Kirstein, began in 1896 to devote his whole time to endoscopy and adapted the oesophagoscope to the direct examination of the trachea; he showed that direct examination could be extended to the bronchi, though von Hacker in 1902 is said to have been the first to introduce a rigid examination tube into the trachea. The oesophago-scopic and bronchoscopic tubes with proximal lighting which Killian designed still remain a standard pattern; he was the first

to remove a foreign body (a bone) from the larynx by the direct method, and he introduced the dorsal position for the patient. His method of suspension laryngoscopy, introduced in 1911 and hailed as a great advance in technique because it allowed both hands to be free, has been elaborated by Clyde Lynch and LeJeune of New Orleans. Brünings of Jena, who had been chief assistant to Killian



FIG. 49
Method of using Kirsstein's Autoscope
(*"Journal of Laryngology and Otology"*)

at Freiburg, made some notable advances in the armamentarium and teaching of proximal-lighting endoscopy, as in later years did Haslinger of Vienna. Killian described his methods at the British Medical Association meeting at Manchester in 1902, and Logan Turner of Edinburgh (1902) and E. B. Waggett of London (1903) were the first in Britain to practise direct oesophagoscopy and bronchoscopy, D. R. Paterson of Cardiff being the first, in 1904, to remove a foreign body—a stay-eyelet—from the trachea (of a female child). In America, Einhorn of New York published the first article there on oesophagoscopy (1897) and designed the

distal lighting of an oesophagoscope in 1902, followed by Ingals of Chicago in 1904. Chevalier Jackson of Philadelphia (formerly of Pittsburgh) who, long before, had visited Morell Mackenzie's clinic in London and had seen him use his skeleton oesophageal tube, in 1904 improved the distal lighting principle, designed a broncho-

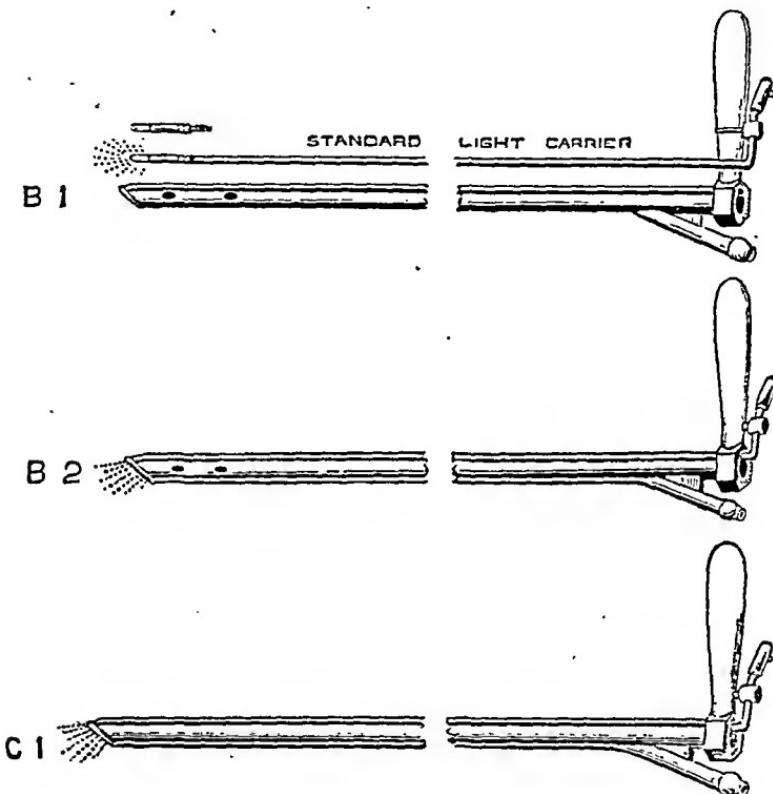


FIG. 50

B 1, standard Jackson bronchoscope used for all purposes, note the lateral breathing holes ; B 2, standard aspirating bronchoscope, having an aspirating canal in the wall of the tube opposite the lamp ; C 1, standard Jackson oesophagoscope with drainage canal opposite the light canal.

(Chevalier Jackson)

scope with a suction tube as well as a light carrier, and attached a useful right-angled handle to the endoscopic tubes. Stimulated first of all by the mechanical problems presented by the removal of foreign bodies from the bronchi and oesophagus, Chevalier Jackson developed the largest clinic and school of endoscopy on either side of the Atlantic. He was the author of the first textbook devoted to the subject, "Tracheo-bronchoscopy, Esophagoscopy and Gastroscopy", published in 1907 at St. Louis. The first



FIG. 51
Insertion of the Bronchoscope

Note direction of the trachea as indicated by the bronchoscope. The operator, having exposed the glottis with the laryngoscope in the left hand, has now transferred his eye to the bronchoscope, which he is insinuating in the glottic chink. The handle of the bronchoscope is to the right and is held lightly, not grasped in the clenched fist.

(*Chevalier and C. L. Jackson*)



FIG. 52
Oesophagoscopy by the High-low Technique

The third—low—step, passing through the thoracic oesophagus. The operator follows the lumen and the assistant at the head follows the operator.

(*Chevalier and C. L. Jackson*)

Chair of Bronchoscopy and Oesophagoscopy was founded in the University of Pennsylvania (Philadelphia) in 1920, Chevalier Jackson being appointed Professor.

Therapeutic bronchoscopy was introduced by Nowotony of Cracow in 1907, when he applied adrenaline by means of the bronchoscope in cases of asthma, bringing about relief. In 1908 Guisez of Paris first began to use radium by means of the oesophagoscope for cancer of the oesophagus, followed in 1909 by William Hill of London; these pioneers had some encouraging palliative results and paved the way for later workers with radium and X-rays.

RECENT DEVELOPMENTS IN ENDOSCOPY

Collective statistics have shown that, in 43,710 endoscopies performed by 190 endoscopists, the mortality has been less than 0·1 per cent. and that, if one considers the bronchoscopy apart from the condition for which it was done, there was no mortality. The passing of a bronchoscope is, however, a skilled procedure, the technique of which can be acquired only through constant practice, and the value of team-work in a bronchoscopic clinic cannot be over-estimated. The absence of all anaesthetics for the passage of a bronchoscope is, theoretically, the ideal, but this is possible only in an ideally equipped clinic, and it is general for the first examination at least to give a small dose of morphine or omnopon, followed by local anaesthetization of the pyriform sinuses and the trachea. Recent advances in basal anaesthesia have greatly facilitated the work of the bronchoscopist. If repeated inspection or treatment is required, the premedication can be omitted and the local anaesthesia diminished as the patient becomes accustomed to the passage of the instrument. Special headpieces and operating tables (such as Haslinger's head-rest and Negus's table) have been devised to assist the bronchoscopist and to lessen the discomfort of the patient.

It has been demonstrated—chiefly by Chevalier Jackson and his school—that the simpler the instrument the safer and more effective is it in use. The innumerable modifications of the early simple instruments have mostly become obsolete, but certain of them, such as the built-in side-tube for aspiration or anaesthetics, or the lens-capped endoscopic lamps, used singly or in pairs, are of established value. The instruments tend today to be of a

smaller bore than formerly and therefore are less inclined to damage the tissues ; as the bronchi and oesophagus will not safely allow of dilatation beyond their normal calibre, it is necessary to have tubes of sizes to fit these passages at various ages in development and at various depths in the bronchial tree, since rupture of a bronchus or of the thoracic oesophagus is almost invariably fatal and even over-distension may be serious.

The experience of the past twenty-five years has produced many accessory instruments for use in endoscopy, and the modern endoscopist can remove a specimen for biopsy or aspirate a bronchial secretion with an instrument so adapted in shape and material that minimal trauma is caused to the tissues. In addition, modern X-ray methods are essential, especially in locating foreign bodies and in facilitating their removal ; the introduction of opaque media, such as lipiodol, through the bronchoscope has the great advantage that a selected region may be injected for more precise examination.

Endoscopy has long outgrown its first limited sphere of usefulness in the removal of foreign bodies from the trachea, bronchi and oesophagus, and today the frontiers of what was a small specialty within a specialty are still extending. The bronchoscope is used by thoracic surgeons and chest physicians even more than by laryngologists, and the oesophagoscope is used by gastro-enterologists and surgeons interested in diseases of the oesophagus and stomach as much as by doctors whose training is primarily in laryngology—except for the removal of foreign bodies. No doctor ought, however, to begin by employing the direct laryngoscope, bronchoscope or oesophagoscope before he has been trained in indirect laryngoscopy and is familiar with the normal and abnormal appearances of the pharynx, post-nasal space, lower pharynx and larynx. In other words, the physician or surgeon who intends to employ the direct laryngoscope, bronchoscope and oesophagoscope, will be well advised to begin his training by learning the ordinary methods of examination, head-mirror or head-light, tongue-depressor, post-nasal mirror, nasal speculum and laryngoscope, all instruments in daily use by the laryngologist.

CONCLUSION

The great interest of the specialty of oto-laryngology is that it still contains so many fascinating and stimulating problems for its

practitioners, who must not be allowed to forget that they are physicians as well as surgeons and philosophers as well as craftsmen. The fenestration operation for otosclerosis, for example, is a masterpiece of technique, but even now the individual patient, however favourable a case he or she may appear to be, cannot be given a definite promise of undoubted improvement—and today the otologist knows no more than Toynbee did a hundred years ago about the cause of otosclerosis. Although we live in the days of antibiotics and isotopes, of vitamins and chemotherapy, of electronics and endocrinology, the Golden Age of Oto-Laryngology is yet to come—when the tonsils cease from troubling and the sinuses are at rest, when doctors send their patients to the otorhinolaryngologist too early rather than too late, when diagnosis can be considered as precisely accurate, when all infections can be effectively controlled, when cancer and tuberculosis are conquered at last, and when deafness can be cured.

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